2021

Get the Wiggles Out: Sensory Paths a Motor-based Intervention to Decrease Out-of-Seat Events in Preschool Children with Special Needs.

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Get the Wiggles Out: Sensory Paths a motor-based intervention to decrease out of seat events in preschool children with special needs.

Presented in Partial Fulfillment of the
Requirements for the Degree of
Doctor of Occupational Therapy

Eastern Kentucky University
College of Health Sciences
Department of Occupational Science and Occupational Therapy

Teresa Ludwig
2021

EASTERN KENTUCKY UNIVERSITY
COLLEGE OF HEALTH SCIENCES
DEPARTMENT OF OCCUPATIONAL SCIENCE AND OCCUPATIONAL THERAPY

This project, written by Teresa Ludwig under direction of Camille Skublik-Peplaski, Faculty Mentor, and approved by members of the project committee, has been presented and accepted in partial fulfillment of requirements for the degree of

DOCTOR OF OCCUPATIONAL THERAPY

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We hereby certify that this Capstone project, submitted by Teresa Ludwig, conforms to acceptable standards and is fully adequate in scope and quality to fulfill the project requirement for the Doctor of Occupational Therapy degree.

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Executive Summary

Background: The number of children with special needs is on the rise. Teachers are experiencing challenges, such as out of seat events and decreased attention when educating the special needs preschool population due to their unique learning needs. The teachers look to occupational therapists for group based, easy to implement, low-cost strategies to decrease out of seat events and increase attention during circle time. Sensory Paths, which are augmented by occupational therapists offer this option to the teachers. Sensory Paths are sensory motor-based interventions that will provide opportunities for teachers to incorporate structured movement into the natural classroom routine, such as before circle time, to help the children in their classes be ready for learning by increasing attention and decreasing out of seat events.

Purpose: This single subject A-B-A design project explored providing structured sensory motor-based opportunities prior to circle time throughout the classroom day to decrease interfering behaviors in the classroom, such as out of seat behaviors and improve attention during circle time.

Theoretical Framework. The Ecology of Human Performance model merges ecological principles, occupational therapy and social science theories/occupational science to create a comprehensive model that identifies not only the functional aspects of a task, but the how and why a person wants to perform a task and how that task leads to a person's self-satisfaction. It looks at the inter-dynamics between the person (children and teachers), task (circle time), the context (environment, habits, roles or rituals) and the performance (optimal performance is indicated by limited to no out of seat events and ability to pay attention).

Methods. This quantitative research project used a single study A-B-A design. This research took place at a 4410, non-for-profit preschool for children with special needs, specifically children with ASD/ADHD/DD or Preschoolers with a Disability. All the subjects (a minimum of 5 students and a maximum of 20, who meet the eligibility criteria were recruited from the 4 possible identified classes) must be enrolled at the designated preschool. This single subject A-B-A design project explored providing structured sensory motor-based opportunities prior to circle time throughout the classroom day to decrease interfering behaviors in the classroom, such as out of seat behaviors and improve attention during circle time.

Results: The results indicate that the Sensory Paths had a positive effect on out of seat events in preschool children with special needs ages three through five. Of the five children who were able to participate in the full study, all demonstrated a decrease in out of seat events as well as therapeutic decleration from Phase A1 to week 1 of Phase B1. Although some children demonstrated a slight increase in out of seat events in week 2 of Phase B1, they remained below the baseline data. Between Phase B1 and Phase A2 all the participants demonstrated a therapeutic acceleration, or increased number of out of seat events. The data collected in Phase A2 indicated that four out of the five children's out of seat events remained below their baseline.

Conclusions: The participants demonstrated a decrease in out of seat events as compared to their baseline with the application of the Sensory Path intervention. Teachers reported the Sensory Paths were easy to implement and were an effective classroom intervention.

Acknowledgements

This capstone project and the research behind it would not have been possible without the exceptional support of my academic advisor, Dr. Camille Skubik-Peplaski, whose constant support and guidance have expanded my mind beyond what I could have ever imagined. I would also like to thank the committee members, Dr. Shirley O'Brien and Dr. Jennifer Hight for the multiple edits and insightful comments.

My sincere thank you to the Staff at Variety Child Learning Center for offering me an opportunity to follow my dream and make a difference when working with children.

I am also grateful for the support of my family and friends whose ongoing encouragement was a beacon in dark hours.

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CERTIFICATION OF AUTHORSHIP

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Title of Submission: _ Get the Wiggles Out: Sensory Paths a motor-based intervention to decrease out of seat events in preschool children with special needs.

Certification of Authorship: I hereby certify that I am the author of this document and that any assistance I received in its preparation is fully acknowledged and disclosed in the document. I have also cited all sources from which I obtained data, ideas, or words that are copied directly or paraphrased in the document. Sources are properly credited according to accepted standards for professional publications. I also certify that this paper was prepared by me for this purpose.

Student's Signature: ____

Date of Submission: __12/2/2021____

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Section One: Nature of the Problem/ Problem Identification

The number of children with special needs is on the rise. According to the Condition of Education, 2021 (COE) there is an increase from thirteen to fourteen percent of total public-school enrollment; between five and ten percent of students served under Individuals with Disabilities Education Act (IDEA) have been diagnosed with autism spectrum disorder (ASD), developmental delays, intellectual disabilities, and emotional disturbances (National Center for Educational Statistics [NCES], 2015; National Council on Disabilities, 2018; Salem, 2018). Principles of the IDEA indicate that children are entitled to education in the least restrictive environment in both the typical and special education settings; therefore, there is a strong focus on the delivery of special education services in general education settings as well as special education settings (Bazyk & Cahill, 2015; NCES, 2015; Salem, 2018). More specifically, the greatest percentage of children ages 3-21 who received special education in the school year 2017-18 were children with specific learning disabilities including ASD, developmental delays (DD), intellectual disabilities, and emotional disturbances (National Council on Disabilities, 2018; NCES, 2015). One in five children, ages 3 to 17, are diagnosed with a mental health disorder including ASD and attention deficit hyperactivity disorder (ADHD) and 35% of children receiving special educational support have a learning disability (Center for Disease Control and Prevention, 2015; National Council on Disabilities 2018). The special needs population is targeted by this capstone project.

Preschool children with ASD, ADHD and DD have unique learning needs that differ from their typical peers, and each child with special needs is unique. While there may be similarities, no two are alike (Abdelbary, 2017). Teachers are required to monitor an individual child closely to determine the level of the impact that the disability has on the child, the type of disability, and/or the impact the disability has on learning (National Association of Special Education Teachers, 2007). When teachers are monitoring and intervening the individual needs of each child, it can take away from their teaching time for the entire class (Benson et al. 2020; Nash, 2016; What's Working 2019). This creates bigger challenges for the teachers identifying and managing the specific needs of each child such as out of seat events or challenges with decreased attention while addressing the needs of the whole group (National Association of Special Education Teachers, 2007; Schmale et al., 2015).

Circle time is an essential part of the preschool child's educational curriculum and typical within the daily routine. Children are required to demonstrate sustained attention and effective executive functioning to participate effectively (Zaghlawan & Ostrosky, 2010). During this time, the teacher presents the lesson to a class of children, all with unique learning styles. Successful circle time requires a highly skilled, competent teacher who can deliver the educational content to learners with varying challenges and learning styles (Zaghlawan & Ostrosky, 2010). Circle time is a way to introduce the "meaning of school" to young learners (Lown, 2002). Typically, the children are seated in a semi-circle configuration around the teacher. Yet, seating options vary from class to class. During circle time, the teacher structures activities that support the student's cognition, language and social emotional development, essential to the learning process (Zaghlawan & Ostrosky, 2010). Social-emotional and cognitive benefits can be tailored as the teachers get to know their students; assess their strengths and weaknesses as well as barriers to learning (Lown, 2002; Zaghlawan & Ostrosky, 2010). Because circle time is essential to the learning process (Lown, 2002) it requires that the teacher spend as much time as possible in an instructional mode and that the children can demonstrate focused attention to the material delivered. Teachers spend two-thirds of circle time "teaching" and approximately one-third of the circle time engaging the children in other activities such as welcome or taking attendance (Kantor, 1988). A common challenge during circle time for preschool teachers is maladaptive behaviors such as out of seat events (Mills & Chapparo, 2017; Zaghlawan & Ostrosky, 2010). A teacher's skill set and comfort in managing maladaptive behaviors such as out of seat events, leaving the circle and events such as laying on floor, crying, screaming, or throwing objects is crucial for successful group learning. For a teacher to be able to pick realistic activities and expectations for the students (Zaghlawan & Ostrosky, 2010) the teacher must have an in-depth understanding of the children. When children who are demonstrating out of seat events, leaving the circle or having a tantrum, they are spending less time paying attention to the circle time content (Wilson & Landa, 2019; Yoder & Williford, 2019). If children have difficulty paying attention during circle time it will affect their ability to learn new information and may also affect their peer's ability to learn new information, including cognitive, language and social skills development (Bustamante et al. 2018; Lown, 2002; Zaghlawan & Ostrosky, 2010). This can apply to all children in the class.

Teachers are successful in identifying behaviors, such as out of seat events, or a child's ability to pay attention during circle time. However, identification is only the first step. Teachers frequently look for effective group strategies to implement to mediate these challenges (Mills & Chapparo, 2017; Wilson & Landa, 2019). Collaboration between the classroom teacher and the occupational therapist can provide a foundation for positive outcomes for children to engage in circle time. During this collaboration, the occupational therapist can provide strategies such as sensory motor-based activities, for the teacher to embed in the daily classroom schedule so that the interventions can be provided throughout the day to enhance a child's attention to tasks (Mills & Chapparo, 2017).

Frequently, occupational therapists will develop a Sensory Activity Schedule (SAS) or prescribe a Sensory Diet (SD) activity for teachers to implement with individual children, to improve their ability to attend to a task (Baranek 2002; Mills & Chapparo, 2017). Examples of these types of activities could include wheelbarrow walking or animal walks, the application of a weighted or compression vest, or jumping on a trampoline. These activities and interventions were found to be successful, yet their implementation posed challenges as they are not group friendly (Baranek, 2002; Mills & Chapparo, 2017).

In 2004, the IDEA embraced the benefits of early intervening and Response to Treatment Intervention [RtI], (U. S. Office of Special Education Programs, 2007). RtI is an evidenced-based model of service delivery that focuses on providing the highest quality intervention that is based on student need. The interventions are then evaluated for efficacy (National Association of State Directors of Special Education 2006; RTI Action Network, 2014). One of the basic tenets of RtI is prevention and early identification of challenges, with the concept being that early identification and intervention decreases the intensity of challenges later in life (Bazyk et al., 2020; VanDerHayden et al., 2005). There are three tiers to the RtI model. The bottom tier is proactive or preventative and is used school wide (AOTA, n.d.). The Sensory Paths can be used as a tier one intervention by the occupational therapist providing professional development to the educational staff regarding the use and benefits of the Sensory Paths. The second tier provides support for children at risk. In this tier educational staff, supported by occupational therapy consultation, can provide additional support to children by creating specific Sensory Paths activities that will address the unique needs of the class. The third tier, or top tier provides specific individualized intervention to support to children who have delays demonstrated through assessments and evaluations. Using the RtI model, occupational therapists can collaborate with teachers at each of the different tiers to support the education staff in supporting the learners.

In addition, teachers reported requiring increased time to learn and master specific SAS/SD activities and that the implementation of individual activities were found to be time prohibitive (Mills & Chapparo, 2017). Therefore, teachers are motivated to implement SAS/SD strategies in the classroom, but they need to be easy to implement, address multiple or a group of children at a time and are time efficient to learn and implement. Sensory Paths offer this option to the teachers.

Sensory Paths are a sensory based-movement intervention that will provide opportunities for teachers to incorporate structured movement into the daily classroom routine to help the children in their classes be ready for learning by increasing attention and decreasing out of seat events (Davis, n.d.; What's Working, 2019). Sensory Paths incorporate movements such as jumping, crawling, spinning, bending, animal walks or wall pushups with colorful, creative environmental markers on the playground to help children build internal sensory pathways. They are colorful, creative and playful ways for kids to build neural sensory pathways, connections in the brain that are responsible for sight, touch, sound, etc., which enable children to complete complex, multi-stage tasks. Sensory Paths engage the senses to help children become focused and prepared for work (Davis, n.d.; What's Working, 2019).

The primary investigator for this capstone project has been a pediatric occupational therapist for over 25 years. This experience revealed that teachers frequently struggle with the management of out of seat events of the children in their classes and turn to occupational therapists to provide effective and easy to implement classroom-based strategies. These types of sensory events or out of seat behaviors have been described as children being fidgety and having difficulty sitting in their seats during quiet learning times (Mills & Chapparo, 2017; What's Working, 2019; Zaghlawan & Ostrosky, 2010). Children who demonstrate restless actions, such as out of seat events during circle time, may have more difficulty paying attention and this movement can be very disruptive to the children around them (Benson et al., 2020; Davis, n.d.; Tyrell, 2019; What's Working 2019). What's Working 2019, suggests that the engagement of sensory movement-based interventions, such as Sensory Paths, prior to learning times, can assist a child to remain seated and therefore improve the child's ability to pay attention. In addition, to an increased ability to pay attention, the authors, reported that the participants felt they could pay attention better and were less distracted, improving their ability to attend to their work, following sensory based-movement interventions. Benson et al., 2020, implied that the application of sensory motor-based interventions can make positive changes on out of seat events and the ability to pay attention by giving a child a chance to build neural pathways prior to a task, to allow for appropriate task engagement.

Children with ASD lead more sedentary lifestyles than that of their typical peers (Casanova, 2017; Editorial Team, 2018; Just et al., 2013). Leading a sedentary lifestyle can affect brain neurochemicals, such as melatonin, which can affect attention and difficulty controlling impulses, potentially leading to out of seat events (Dunckley, 2016). According to The Active Family (2018), children with sedentary lifestyles can have decreased performance in school. Another contributing factor to a sedentary lifestyle is increased use of technology screens (Benson et al., 2020; Downey & Rapport, 2012; Lue, 2013; Rymanowicz, 2018; Sowa & Meulenbroek, 2012; Yogman, et al., 2018). Dunckley 2016, has coined the term "Electronic Screen Syndrome", where she proposes that the brains of children with autism are more sensitive to screen time causing maladaptive behaviors such as hyperarousal, chronic stress emotional dysregulation and overstimulation. However, evidence suggests that exercise and aerobic activities can be beneficial in reducing maladaptive behaviors, such as out of seat events and difficulty paying attention for children with ASD (Bittner et al., 2018; Chazin et al., 2017; Petrus et al., 2008; Sowa & Meulenbroek, 2012), by releasing brain chemicals that can have a calming effect on the body (Koziol et al., 2011; Vaynman & Gomez-Pinilla, 2005). Aerobic activities can be defined as, "an activity in which the body's large muscles move in a rhythmic manner for a sustained period of time" (Centers for Disease Control and Prevention, as quoted in Bittner et al., 2018, p.16). For older children, aerobic activity can include swimming or jogging, but for preschooler's aerobic activity is equitable to that of playground play (Chazin et al., 2017). Typical playground play for the preschool population can be described as running, jumping, skipping, climbing and playing chase (Chazin et al., 2017; Delaney, 2010; Great Schools Staff, 2015; Your Therapy Source, 2016).

Problem statement

The problem this capstone project addressed was to develop an evidenced based, low cost, easy to administer intervention that teachers can implement during the classroom day to decrease out of seat events and improve preschoolers attention to tasks during circle time. This capstone project also attempted to fill a gap in the literature regarding efficacy of Sensory Paths.

Purpose of the project

The purpose of this single subject A-B-A design capstone project was to test the hypothesis that providing structured sensory motor-based opportunities prior to circle time throughout the classroom day will decrease interfering behaviors in the classroom, such as out of seat events and improve attention during circle time, the null hypothesis was that these events were due to chance. This study will examine the relationship between providing aerobic movement via Sensory Paths and the frequency of out of seat behaviors during circle time in preschool children with special needs. By testing this hypothesis, effective classroom interventions, such as Sensory Paths, to address children's out of seat events and improve attention can be validated.

Research question

What are the effects of Sensory Paths on a child's ability to pay attention as measured by out of seat events in preschool children with ADHD, ASD and DD?

Theoretical framework or scientific underpinnings

In the early 1970's theorists such as Burke, Kielhofner and King identified that during the reductionist period of the occupational therapy profession, human beings lost their individuality and therapeutic interventions became septic; value and personal saliency was washed away from function, leaving only the task without meaning (Clark & Larson, 1993). In response to this, Occupational Science emerged as a discipline and is defined as a "basic science" that seeks to understand the meaning that people assign to what they do, as well as the nature of being human and how human beings realize their full potential in health and well-being through purposeful activity (Clark, 1993; Clark & Larson, 1993; Sainburg et al., 2017; Wilcock, 1993; Wilcock, 2005; Wright-St Clair & Hocking, 2014). The discipline of occupational science uses the scientific method to develop theories and frames of reference to guide the occupational therapist in blending the biological, physiological and information processing subsystems, with those subsystems addressing social, cultural, symbolic, and transcendental components (Wright-St Clair & Hocking, 2014). Only a true blend will help the client to achieve their own goals of health and well-being through self-fulfillment achieved by assigning meaning to an occupation (Clark, 1993; Clark & Larson, 1993; Sainburg et al., 2017; Wilcock, 1993; Wilcock, 2005; Wright-St Clair & Hocking, 2014).

Occupational therapists are charged with the task of looking at all aspects of the client. In this capstone project, the clients are the teachers, and the children in their classes. The marriage of occupational therapy to occupational science is an important step in supporting the occupational therapist in providing client-based treatments and interventions. This collaboration supports the occupational therapist in providing client centered, occupation-based intervention in the most natural environment (Clark, 1993). The use of Ecology of Human Performance (EHP) in this capstone project ensures the concept that people are evolving open system beings that do not live in a vacuum (Dunn et al., 1994). This capstone project requires the use of a model theory that merges ecological principles, occupational therapy and social sciences theories/occupational science and speaks to the interdependent nature of the relationship between the person and the environment; and how this relationship impacts human performance.

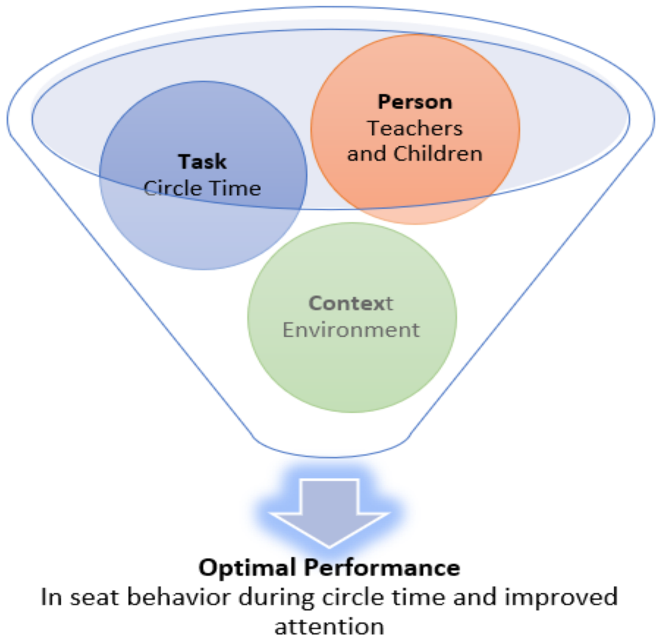
EHP theory looks at the inter relationship between the components of person, task, context, and performance. Additionally, it provides a framework for intervention that is customizable to the client's specific needs that are derived from the specific inter-dynamics of the client, the task, the context and performance. The EHP model demonstrates that changes can be made in multiple components of a client's occupation to ensure meaningful engagement and the client's ability to achieve self-satisfaction and well-being (Dunn et al., 1994). The American Occupational Therapy Practice Framework 4th edition (2020, [OTPF-4th]), highlights the four cornerstones of occupational therapy (therapeutic use of self, core values align with occupation, professionalism and the use of occupations as interventions). The language in the OTPF-4th

describes all aspects of occupational therapy and has an emphasis on occupation-based activities and client centered goals.

Occupation is a key component to the work of Occupational Therapists, but what does occupation really mean? The literature suggests there are many different definitions of occupation and activity including that an occupational activity is a task the people participate in over and over that has value beyond the external results (Clark & Larson, 1993; Sainburg et al., 2017;Wilcock, 1993). The literature suggests that adult character/occupations are built upon childhood occupations (Clark, 1993; Wilcock, 1993; Wilcock, 2005). This is important to this capstone project because the ability of the teacher to effectively shape the lives of the children of today, as healthy, well-being, self-fulfilled human beings, relies on providing a high quality of support.

EHP has its basis founded in occupation-based evaluation and treatment. The concepts that are utilized in this capstone project are the inter-dynamics between the person (children and teachers), task (circle time), the context (environment, habits, roles or rituals) and the performance (optimal performance is limited to number of out of seat events and ability to attend to a task) see figure 1.

Figure 1: Ecology of Human Performance



The EHP intervention guidelines address five unique foci for therapy. Two are utilized in this capstone project: "Create" (augmenting opportunities to promote optimal performance in circle time using the Sensory Paths) and "Prevent" (use of Sensory Paths prior to circle time may prevent out of seat events).

Significance of the study

This project is important to teachers, students, and occupational therapists as it provides evidence for a new model of service delivery. Teachers are spending more time trying to manage out of seat events, leading to decreased attention to classroom tasks and having less time to educate the students in their classroom settings (Zaghlawan & Ostrosky, 2010). Teachers look to the expertise of the occupational therapists to collaborate and develop interventions that will mediate inattention and out of seat events. The results of this study will fill a gap in the literature regarding the efficacy of sensory motor-based intervention on attention and out of seat events with preschool students. This evidence can be used to guide the occupational therapists in their decision making when collaborating with the teachers to solve the problem of inattention and out of seat events. This project has highlighted the challenges teachers are having in the classroom managing inattention/out of seat events, the possible difficulties communicating these challenges and the lack of evidence-based resources for occupational therapists to use to assist the teachers and the students in their class. Because this capstone project identifies challenges that occupational therapists face anecdotally, the results will bridge the gap between the clinical opinion of both the occupational therapist and the teacher and use of evidence to guide clinical decision making.

This study can also have an impact on funding. Frequently, sensory motor-based interventions are not funded by insurance or identified as evidence-based options for use in school districts. Limited evidence exists showing the effectiveness of these sensory-motor types of interventions. When speaking to occupational therapists anecdotally, without evidence, many professionals, such as occupational therapists, have expressed the feeling that sensory motor-based types of interventions are not valid. One type of intervention with supporting evidence is Applied Behavioral Analysis (ABA), a treatment intervention that has a significant amount of support in the literature for efficacy to address attention and out of seat events in the classroom (Magee & Ellis, 2000). ABA therapies are more readily funded by insurance and supported for use in school districts because of their supporting evidence. Many of the ABA studies used single subject and case designs, such as the methodology used in this capstone project. As occupational therapists, we need to be able to support our treatment interventions so that we, too, can gain funding based on effective interventions.

The number of children with special needs in school is on the rise (NCES 2015). This puts increased stressors on teachers who must find a way to manage the children in their classroom with varying degrees of needs and disabilities. The use of aerobic sensory motor-based intervention, such as the Sensory Paths, can support the teachers and their learners by providing structured movement opportunities embedded in the classroom routine, which will enhance sensory pathways in the brain and help learners attend and prepare for learning (Design, n.d; Ratey & Hagerman, 2013). The purpose of this capstone project was to investigate the effects that Sensory Paths may have on out of seat events during circle time in children with special needs. This low cost, potentially high benefit intervention can improve learning without taking additional time and resources from the teacher.

Operational Definition of Terms

Out of seat events- In the study environment all the participants sat in chair during circle time, therefore, out of seat events are each event where most of the child's body weight is no longer supported by the chair. This could include standing up, sliding out of the chair, laying on the floor or leaning on the chair while the child is positioned on the floor. The event ends when most of the child's weight is supported by the chair. The child's feet need not touch the floor as alternative sitting options, such as legs crossed, or tailor sitting are acceptable.

Sensory Seeking Behaviors- A child's excessive reaction to sensory input, flapping, pacing, crashing into things, excessive need to touch objects.

Attention- The ability for a child to remain focused and engaged in the circle time activity as evidenced by remaining in their seat, looking at the teacher, interacting as required by the lesson.

Sustained Attention- The ability for a child to maintain attention on the teacher/circle time activity and ignore stimuli not connected to the lesson.

Executive Functioning- The child's ability to sit still, resist distractions, exert self-control, and follow the rules.

Sensory Paths - Colorful environmental markers that are painted on the ground of the playground to build sensory motor-based movement patterns. These markers provide visual cues to the children to encourage them to participate in sequences of typical playground movements such as walking briskly, jumping, skipping, walking in a figure 8 pattern and bear walking.

Section Two: Literature Review

The literature review for this capstone project explored the benefits of collaboration between the teacher and the occupational therapist to provide a multi-discipline approach to augment and implement teacher driven interventions, which can be embedded into the natural environment to mediate the challenges of circle time. The literature review used CINHAL COMPLETE, ERIC, ACADEMIC SEARCH, OT SEARCH AND GOOGLE SEARCH, search engines, with the key words, sensory paths, sensory, exercise, collaboration, teacher, OT, preschool, circle time, autism, out of seat, challenging behaviors, teacher's perceptions, brains. The Sensory Path intervention embraces theories of differences in the brains of children with ASD/ADHD/DD as well as proposed relationships of sensory motor-based interventions and the ability to pay attention by featuring how sensory motor-based interventions, such as Sensory Paths, can be an effective tool to decrease sensory seeking behaviors that manifest as out of seat events and decrease attention. Additionally, this literature review attempts to detail the importance of circle time and the challenges teachers face when executing circle time activities. Examples of challenges include sensory seeking behaviors from children, decreased attention and sustained attention of the children, decreased executive functioning, and out of seat events.

Collaboration in the educational setting

Many teachers view the management of sensory seeking or out of seat behaviors as scope of practice that falls under occupational therapy in addition to other related services (Mills and Chapparo, 2017). When exploring teachers' perspectives of using a Sensory Activity Schedule (SAS) the authors found that teachers had positive experiences regarding collaborating with occupational therapists and learning new ideas. From the collaboration, teachers observed a decrease in interfering behaviors and an increase in attention of the students. In addition, the study reported teachers' struggling and reporting negative feedback regarding finding time and staff assistance to complete the (SAS) as well as their fears of not performing the activities correctly. Wilson & Harris (2017) studied the perceptions of teachers using the Partnering For Change (P4C) model for collaboration with occupational therapists. The barriers for collaboration identified included: large caseloads, lack of time, funding, role confusion, poor communication, lack of administrative support, lack of regular therapists and lack of ability to establish relationships with the teachers. Even with these barriers the results of this study indicated that teachers had positive experiences collaborating with occupational therapists and that the teachers felt ultimately that it had a positive result with their students. Despite the identified obstacles to the collaboration process, the teachers report that the outcomes of collaboration have been shown to benefit the students (Mills & Chapparo, 2017; Wilson & Harris, 2017). In a study focused on the use of non-sensory integration occupational therapy interventions, Polatajko & Cantin (2010), concluded that a consultation model of service (typically used in schools) as well as a direct delivery model (used in private practice) for individuals with difficulty with sensory processing is an effective model supporting the collaboration of teachers and occupational therapists in delivering the Sensory Paths intervention. Thus, occupational therapists are well suited to collaborate with the teachers to augment specific Sensory Path interventions that the teachers could implement into their classrooms.

Neuroscience underpinnings of sensory motor activities

Evidence identifies that child with ASD/ADHD/DD have different brain wiring and neurochemical interactions than their typical developing peers. In a review of neurochemical complexities of children with ASD, Marotta et al., 2020 described how neuropeptides and neurotransmitters play a role in motor regulation in addition to memory and behavior. The authors espouse that a child with ASD may have an excitatory/inhibitory neurotransmitter system imbalance affecting neuro chemicals GABA and glutamate, serotonin, dopamine, N-acetyl aspartate, oxytocin, arginine-vasopressin, melatonin, vitamin D, orexin, opioids, and acetylcholine that may contribute to the onset of ASD. Additionally, Jacob and Nienborg (2018), completed a review that looked in part at the physiology of serotonergic modulation, and concluded that the way that the brain perceives the importance of serotonin can affect inhibition of behavior, or the ability to wait or the persistence required for completing a task or activity (Jacob & Nienborg, 2018; Lottem et al., 2018; Miyazaki et al., 2014). Sowa et al. (2012), conducted a meta-analysis of 16 behavioral studies that looked at a total of 133 children and adults with ASD that were offered structured physical /sensory motor-based activities. The authors indicated the positive benefits of physical/sensory motor-based exercise on an individual’s motor and social limitations. For children with ASD, Bittner et al, (2018) investigated several types of aerobic exercise and their effects throughout the school day. He suggests that activities such as jogging can impact academic engagement and exergaming (like playing the WII, or Virtual Gaming) can also improve attention. These aerobic activities are very similar to the activities found along the Sensory Paths.

Koziol et al., (2011), completed a study indicating that children with special needs frequently demonstrate sensory seeking behaviors. The authors investigated the relationship and interactions between the neocortex, the basal ganglia, and the cerebellum. Each of these brain regions have contributions to sensation and perception, cognition, emotion and affect, and motor adaptation, leading the authors to believe that disturbances in sensory processing, including inattention, can be a result of abnormal structures or neurochemistry in the basal ganglia and cerebellum. Frequently, abnormalities in these structures are identified in children with DD, supporting their conclusion that children with ASD can have sensory seeking behaviors due to structural and neurochemical abnormalities.

There is also evidence that suggests that there is an inverse relationship between sensory seeking actions such as out of seat events and learning cognitive skills. Ashburner et al., (2008), investigated the association between sensory processing and classroom attention, and behavioral and educational outcomes of children with ASD/ADHD/DD. They compared the average IQ range of 28 children with ASD to 51 typical children that were matched by age and gender and investigated the relationship between sensory processing challenges and educational outcomes. The results of this study indicated that children with difficulty with auditory filtering, sensory under-responsiveness and sensory seeking behaviors were associated with academic underachievement due to inattention and distractibility. The authors postulate that there is support for the use of sensory movement-based interventions for children with ASD, however there is a limited number of empirical studies in the literature that can indicate whether these interventions are effective or not (Ashburner et al., 2008; Bodison & Parham, 2017; Case-Smith

& Arbesman, 2008; Hodgetts & Hodgetts, 2007). Baranek (2002), completed a scoping review of the literature by looking at different treatment interventions (sensory motor-based interventions, massage, sensory integration interventions, visual therapies, physical exercise, and auditory interventions). The results indicated that physical exercise/sensory motor-based activities could have some benefit in reducing self-stimulatory behaviors and out of seat events which may in turn improve attention.

Sensory Diets

Sensory diets are a strategy used within occupational therapy practice. Each sensory diet is individualized to address the needs of the child (Admin, 2016; Nackley, 2001; Delaney, 2010). Sensory diets often consist of sensory and movement components. Nackley (2001), investigated the use of a sensory diet/environmental modification to address development for children with sensory processing challenges in the classroom. The author describes six categories of sensory processing that can be addressed through a sensory diet: decreased discrimination of vestibular and proprioceptive input; decreased discrimination of tactile information; somatosensory dyspraxia; impaired bilateral motor coordination tactile defensiveness and gravitational insecurities. The authors provided a comprehensive list of sensory diets, sensory motor-based interventions and environmental modifications appropriate for the six different activity categories where a child’s inattention may be challenged. Movement is a crucial part of a successful sensory diet, and playground play is an appropriate activity for 5/6 categories listed above (Nackley, 2001). Sahoo and Senapati (2014) investigated the benefits of outdoor play with interventions to improve sensory processing in 28 subjects with ADHD, 6 to 12 years old. The authors concluded that outdoor play and interventions focusing on improving sensory processing were more effective than interventions to improve sensory processing alone. Thus, movement activities, such as Sensory Paths, can meet the sensory needs in children during the classroom day, providing a richer classroom experience than just individual therapy alone.

Sensory Processing and Attention

Ashburner et al., (2008) looked at the associations between sensory processing and: classroom attention, emotional regulation, behavioral events and educational outcomes of children with ASD. They concluded that children with ASD respond differently to sensory input then their typical peers. causing decreased attention, decreased emotional regulation, increased nonproductive behavioral outbursts which are associated with academic underachievement (Ashburner et al., 2008). O'Donnell, (2012) explored sensory processing characteristics and their impact on preschool age children with ASD. They found that a relationship exists between sensory processing and problem behavior, adaptive behavior and cognitive functioning and the differences in sensory processing between the two subgroups ASD and pervasive developmental disorders. The findings of this study indicated that the higher levels of sensory processing difficulties were more consistently associated with higher levels of behavior challenges for the children. Pfeiffer and colleagues (2011) completed a study to identify appropriate outcome measures and address the effectiveness of sensory integration interventions in children with Autism Spectrum Disorders (ASD). Their results supported the use of Sensory Integration (SI) treatment in children with ASD, as children who received SI intervention showed progress toward individualized goals and a decrease in autistic mannerisms, including sensory seeking behaviors and out of seat events. Additionally, this study suggested that the benefits of providing interventions that are generalized to natural environments, such as in the classroom, playground or child's home are greater than individual therapies alone. There is an added benefit of having interventions that are specific by addressing the needs of the child during specific times of the day, within a natural context.

Learning and Attention

An underpinning of this capstone project is the relationship between the ability to pay attention/learning/academic achievement and sensory movement-based activities such as the Sensory Paths. The literature supports the relationship between academic achievement and effective learning, and that a prerequisite to learning is attention (Cherry, 2019; Geertsen et al., 2016; Lown, 2002; Zaghlawan & Ostrosky, 2010). The literature uses a wide variety of terms related to attention, such as attention, sustained attention, and shift or divided attention. Many authors assign Executive Functioning (EF) as the overarching theme for these components (Gatz et al., 2018; Nakutin & Gutierrez, 2019; Meyer & Larson, n.d.). Children with ASD demonstrate more challenges with attention, as compared to their peers, with specific types such as, selective attention, sustained attention and shift attention (Crasta et al., 2020) as well as EF and self-control (Gall et al., 2018; Gatz et al., 2018; Geertsen et al., 2016; Nakutin & Gutierrez, 2019; Schmidt et al., 2019). Additionally, there are studies that report that higher cognitive functioning is directly related to neuroplasticity and that neuroplasticity helps to develop EF and its subcomponents (Pan, 2018; Svedenkrans et al., 2016). Svedenkrans et al., (2016), also reports that increased physical activity, such as the sensory paths can improve neural plasticity therefore improving EF, attention and learning. There is further evidence to support this concept. Gatz et al. (2018) describe the EF hypothesis as one that predicts that EF and cognition will demonstrate larger improvements from physical activity, (Gatz et al., 2018) and that physical activity can improve attention (Egger et al., 2019; Mah & Doherty, 2021; Watson et al., 2017). The specific connection made here is that physical activity can improve EF including attention, therefore making a positive impact upon learning and academic achievement (Wassenaar et al., 2019).

Summary

The evidence in the literature demonstrates the efficacy of a sensory motor-based integration frame of reference as well as aerobic sensory movement-based therapies, such as playground play and aerobic exercise to decrease sensory seeking behaviors in the classroom, which manifest as out of seat behaviors and improve attention for children with ASD/ADHD/DD. The importance of attention to task for learning includes remaining seated and attending during circle time for the preschool population. A review of the literature revealed the lack of empirical evidence to support sensory based and sensory based movement interventions to manage decreased attention during circle time and out of seat events.

Section Three: Methods

Project Design

Sensory Paths is an intervention to help children "get their wiggles out" by providing structured movement breaks, prior to circle time, to decrease out of seat events in children with ASD/ADHD/DD. This capstone project studied the relationship between sensory movement breaks via Sensory Paths, and out of seat events during circle time in preschool children ages three to five years of age.

This quantitative research project used a single subject A-B-A design (Kennedy, 2005). The participant's out of seat events was observed during circle time at baseline prior to the implementation of the Sensory Paths (A1), during the implementation of the Sensory Paths (B1), and with the withdrawal of the Sensory Path activities (A2). Children of English-speaking families who have met the inclusion criteria were eligible for the study after parent consent (Appendix A) was received. All the children who met the eligibility criteria in the identified classes (cohort) participated; these children served as their own control group in an A-B-A design. The independent variable in this design was the implementation of the Sensory Paths. The data was collected during phase A1 on a Daily Data Collection Sheet (Appendix B). The Daily Data Collection Sheet is a grid with space to document the participants out of seat events during circle time. Each class had their own grid. On the top of the grid were the names of the participants in that class. Below each name were 40 squares to document an out of seat event during circle time, as it is observed by the primary researcher or assistant by placing a check in the box. At the end of the circle time the total number of observed out of seat events were added together and recorded at the bottom of the column. The Weekly Data Collection Sheet (Appendix C) had the names of all participants listed on the left column and going across the page was a box for the total out of seat events that was recorded for a particular child. The collected data (dependent variable) was plotted on a graph, visually analyzed, and inferences were made about the relationships between out of seat events and the implementation of the Sensory Paths (Kennedy, 2005; Ottenbacher, 1986).

Inclusion Exclusion Criteria

The inclusion criteria for this research study are that all the children must be enrolled in the school that the study took place in, be English speaking, enrolled in one of the four classes that were identified to participate in the study, and consent signed by the legal guardians. Exclusion criteria includes legal guardians not signing the consent and children who speak English as a second language.

Setting

This capstone study took place in a preschool for children with special needs located in the suburbs of New York City.

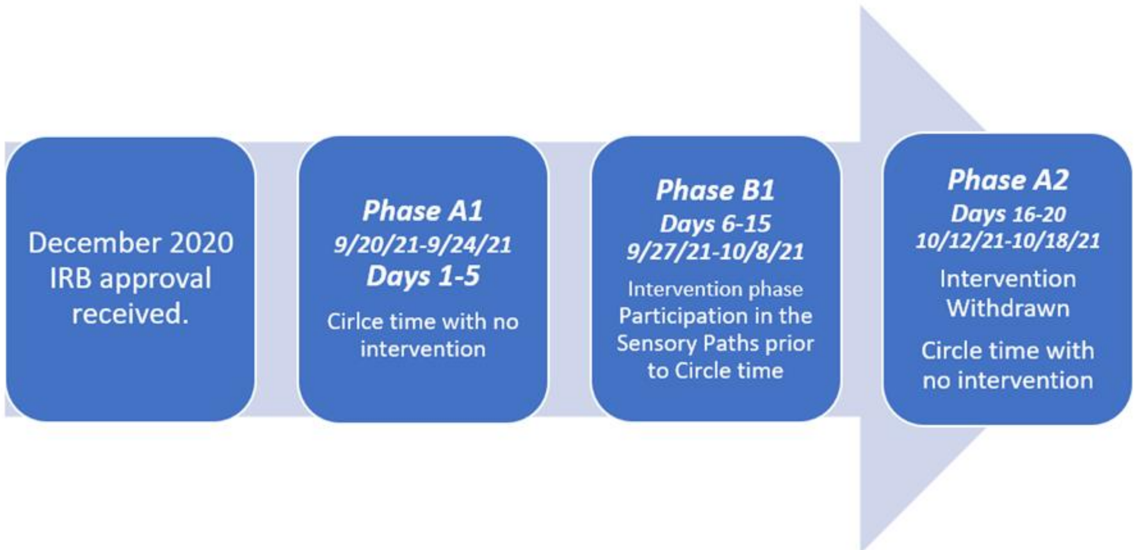
Recruitment procedures

Students who met the eligibility criteria were recruited from the four possible identified classes. A cover letter and flyer (Appendix D) explaining the study, risks, and benefits was provided to the families via the participants' backpacks as well as email. The flyer had a return tab, as well as contact information of the primary investigator, in the event that the parent/caregiver indicated an interest in participation as well as being able to ask questions. Those families who were interested met with the primary investigator via telephone, zoom or face to face to complete the inclusion screening and sign the consent form.

Project Procedures

The IRB for this project was approved (3708) on December 24, 2020. The participants were screened and coded for age, gender, disability classification per Individualized Educational Plan (IEP), alternate diagnosis per chart review and class size. There were two data collectors for this project, the primary investigator and a trained Level II occupational therapy student. The two data collectors observed the classes for 5 school days and tracked out of seat events (Phase A1). On days 6-10, the classes participated in the Sensory Path intervention and returned to the classroom for circle time, where they were observed and out of seat events documented (Phase B1). On days 11-15 (Phase A2 withdrawal phase), the classes did not participate in the Sensory Path intervention, data collectors observed the classes during circle time and out of seat events were recorded, figure 2. Reflects the timeline of this capstone project.

Figure 2:Capstone Project Timeline



Processes to ensure validity

The outcome measures of this capstone project were the data that was collected from observations of out of seat events and the interrater reliability of the two data collectors. The data from the out of seat events was plotted on graphs and visually inspected to identify changes in the number of out of seat events, and any trends or latent results. One way to ensure reliability, is to standardize the data recording process (Kennedy, 2005). The directions for tracking the data were simple and easy to follow. Constructs were operationally defined to ensure rater consistency. During the first two days of data collection there were three events where the data collectors were able to observe the same class at the same time to collect out of seat events. Notes were taken separately and there was no discussion between the data collectors. The data collected between the two data collectors was then analyzed through Cohen's Kappa statistics. Cohen's Kappa statistics is a way to look at interrater reliability as well as remove the possibility of episodes by chance (McHugh, 2021). The reliability coefficient was .4 indicating that the interrater reliability was moderate (Landis & Koch, 1977).

To maintain consistency in the implementation of the Sensory Paths, teachers and teaching assistants were trained in the use of the Sensory Paths, as well as provided with specific structured activities that the children could participate in for the daily 10- 20-minute intervention session. These activities ranged from simple, such as walking along the paths at a brisk pace, to more complex, involving jumping, turning or frog jumps. For the purposes of this study, the simplest movement, walking, was the suggested movement pattern for the classes. Choosing the simplest movement ensured that all the children, in all the classes, would be able to participate in the Sensory Path intervention. In addition, one teaching assistant was trained in the use of the Sensory Paths, including higher level movement patterns and was dedicated to leading all the classes in the Sensory Path activities. Teachers, teaching assistants, and the dedicated teaching assistant were also asked to identify if any of the children did not participate for a minimum of 10 minutes each day during the study. The data collectors reflected this in their field notes.

Potential threats to external validity included that the setting of the project, the identified preschool, may not be the same as that of other schools, especially those located outside of the upper eastern United States. Additionally, although unstructured, the children had access to the Sensory Paths during their classroom recess time. Other potential threats to external validity are extraneous variables. Extraneous variables are non-controlled variables that are neither a dependent nor an independent variable (Kennedy, 2005). Such potential extraneous variables could include the weather, COVID, the health of the child, as well as unanticipated events such as fire drills, lockout drills, injuries or other classroom emergencies.

Ethical Considerations

Since this study worked with a vulnerable population, proper consent from legal guardians were obtained and the files were maintained in a locked desk draw. Assents were not required for this capstone project as the literature suggests that the minimal age for a child to make an informed consent is 7 years old (Whittle et al., 2004). The subjects of this study were significantly younger and had special needs that can affect cognition. Therefore, legal guardians' consents were only used.

Prior to the study, every family in the four classes, received information regarding the study, and those who were interested completed a consent/permission slip that they signed for their child to participate in the study. The consent/permission slip indicated the purpose of the study, potential risks and benefits, as well as designation of primary researcher. Additionally, no family was pressured to participate in the study and could withdraw at any time. Disclosure and purpose of the study was written in clear simple language. Additionally, this information could have been presented to the families in ways other than written material if needed. All the children, whether they were participating in the study or not, had access to the Sensory Paths during outside free time. This way all children had equal access to the Sensory Path and families should not feel as though they had to participate in the study to have access.

At the conclusion of this study the sensitive information regarding the children such as name, age, gender, classification, and classroom was deidentified. Daily and weekly tracking sheets were deidentified and kept in a locked file cabinet in the locked office of the principal investigator. At the conclusion of the capstone project, the data was filed confidentially in a locked cabinet at EKU for 3 years. This study was approved by the IRB at Eastern Kentucky University.

Section Four: Results

This single study A-B-A design (Kennedy, 2005) recruited a total of 9 participants, preschool children, across 4 different classrooms (A-D). There were two children in Class A, two children in Class B, three children in Class C, and two children in class D. All classes were able to completely participate in the first phase (Phase A1) of the study. At the end of the first week of phase B1, the second week of the study, two classes (A and B) were quarantined due to COVID, and data could no longer be collected for those participants. Due to this, only five children across two classes (C and D) were able to successfully participate in all three phases of the research study.

Table 1 is the Table of the Participants. This table identifies how many children from each class participated, the gender of the participant, the age ranges per class and the child: teacher: teaching assistant ratio. Due to COVID, classes A and B were unable to participate in the study to its entirety. Classes C and D (highlighted in grey and bolded font) did not have to quarantine and were able to participate in the study to completion.

Table 1 Table of Participants

Class Distribution				
	Class A	Class B	**Class C**	**Class D**
Total number of Participants	2	2	**3**	**2**
Female	1	2	**0**	**1**
Male	1	0	**3**	**1**
Age Range	4:5-4:7	3:3-4:7	**3:0-4:4**	**3:2-3:9**
Class Size (children, teacher, teaching assistants)	12:1:2	8:1:3	**8:1:3**	**8:1:3**

*Grey/bold shading indicates classes that completed the study.

Table 2 indicates the distribution of the participants age, gender and diagnosis (diagnoses retrieved from the Individual Educational Program [IEP] and clinical chart review). Children A-D were enrolled in classes A and B. Children E-I (highlighted in grey and bolded) were enrolled in classes C and D and were able to participate in the study to completion.

Table 2 Distribution of age, gender and diagnosis

	Age	Gender	Diagnosis	Diagnosis Code per MD prescription	Diagnosis Code Description
Child A	4:5	M	PSD		
Child B	4:7	F	PSD		
Child C	4:7	M	PSD		
Child D	3:3	M	PSD		
Child E	4:4	M	PSD	F82	Specific Development Disorder of Motor Function
Child F	4:3	M	PSD	F84	Autism
Child G	3:0	M	PSD	F82	Specific Development Disorder of Motor Function
Child H	3:9	F	PSD	F82 R62.50	Specific Development Disorder of Motor Function Unspecified lack of expected normal physiological development
Child I	3:2	M	PSD	F82 R62.50	Specific Development Disorder of Motor Function Unspecified lack of expected normal physiological development

*PSD is preschooler with a disability

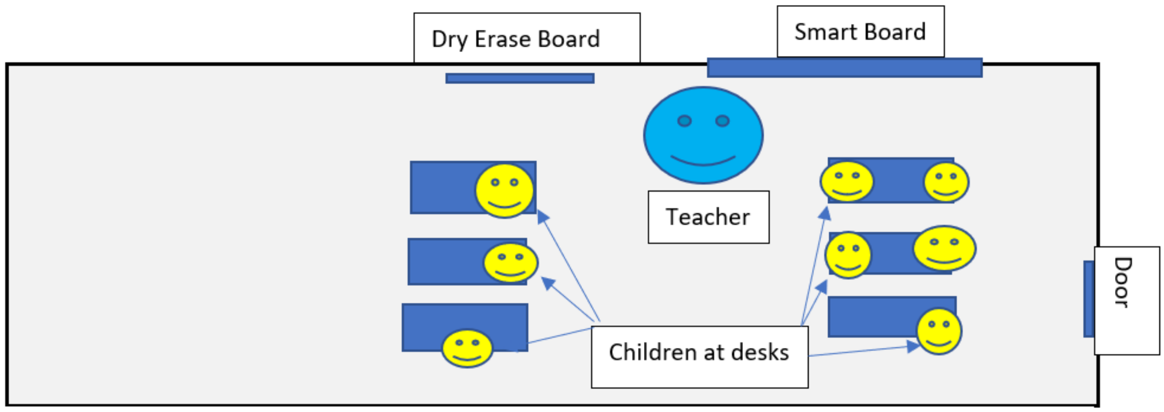
**Grey shading indicates subjects that completed the study

Description of the circle time for each class

Circle time was individualized for each of the four classes based on teacher preference. Classroom A and Classroom B were not able to complete the study due to COVID and therefore not described here.

Classroom C (see figure 3) had children seated in molded chairs at a 28-inch table. Some students had two children per desk, others had one child per desk. There was a total of three rows and six desks. All the desks were facing the teacher and the smart board. Figure 3 shows the teacher as the larger blue smiley face and the children as smaller yellow smiley faces. The dry erase board was next to the smart board.

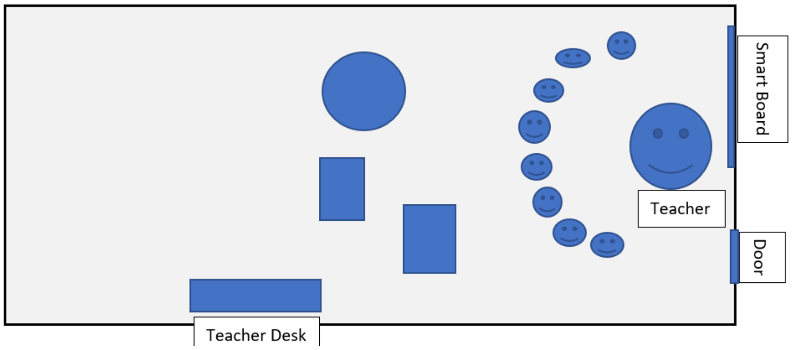
Figure 3: Class C



The circle time for class C ran for 30 minutes in total. It began with the days of the week activity where the teacher had visuals of the different days of the week and a calendar that was attached to a dry erase board. The children identified the Month, Day and Year, and then the children counted the number of days. The next activity was who is in school. This activity required the students to visually identify their name, spell their name and answer a question about their gender; are you a boy or a girl? The materials for the "What is your name?" activity consisted of laminated cards that had each child's name on it. There was one card for each student. The teacher would hold the card in the air and ask, 'who is this?' Following this activity, the letter of the week, the color of the week, calendar, and the weather were taught with the use of the smartboard. The circle time ended with a closing movement activity.

In classroom D (see figure 4) the teacher is represented by the large blue smiley face and the children are represented by the small blue smiley faces. The large blue circle and large rectangles represent classroom furniture that was not used during the circle time activity. In Classroom D the children were arranged in a semicircle around the teacher and the smart board. The children were seated in small, molded seats that were approximately a foot apart (no tables). The semicircle was approximately 3 feet from the smart board.

Figure 4: Class D



The circle time ran for approximately 25 minutes and began with a video to prepare and transition the children to the activity (approximately 5 minutes). The teacher then instructed on the letter of the week and the sound the letter made with laminated visuals to assist the children. The children were intermittently asked to come up to the teacher to complete a simple activity related to the letter, for example, to place apples on a tree or visually identifying letters on the smart board (approximately 10 minutes). Following the letter of the week activity, the teacher played instructional videos on the smart board, including the alphabet song and Pete the Cat.

The data from participants E, F, G, H, and I were collected across all three intervention phases of this research project. Phase A1 lasted for five days, Phase B1 lasted for ten days, Phase A2 lasted for five days. The collected data was plotted in online graphs, where the x-axis represented the day of the trial and the y-axis represented the number of out of seat events in one circle time. The data was then visually analyzed within phases to determine trend, magnitude and variability, to determine if the changes in data points could be due to the intervention. Celeration lines were used to analyze the trend of the data between Phase A1 and Phase B1, as well as between Phase B1 and Phase A2. The split middle line was used to analyze data between phases to determine changes. A binomial analysis was conducted in order to determine if the out of seat events could have occurred due to chance (and to verify the null hypothesis, that the change in data points was due to chance). The slope of the trend and celeration lines was calculated to determine trend.

Visual Analysis of Child E

The visual analysis of child E, Figure 5, demonstrates that Child E was present for the data collection in Phase A. Child E demonstrated a fluctuation of out of seat events during from five to nine. During Phase B1, the Sensory Paths were unavailable due to severe weather and data was not collected. Additionally, Child E was absent on day eight and nine of data collection during Phase B1. During Phase B1, Child E demonstrated fluctuations in out of seat events, ranging from zero to three. Child E was present during for all the collection days in Phase A2 and demonstrated a fluctuation of out of seat events ranging from zero to three.

Figure 5: Out of seat events child E

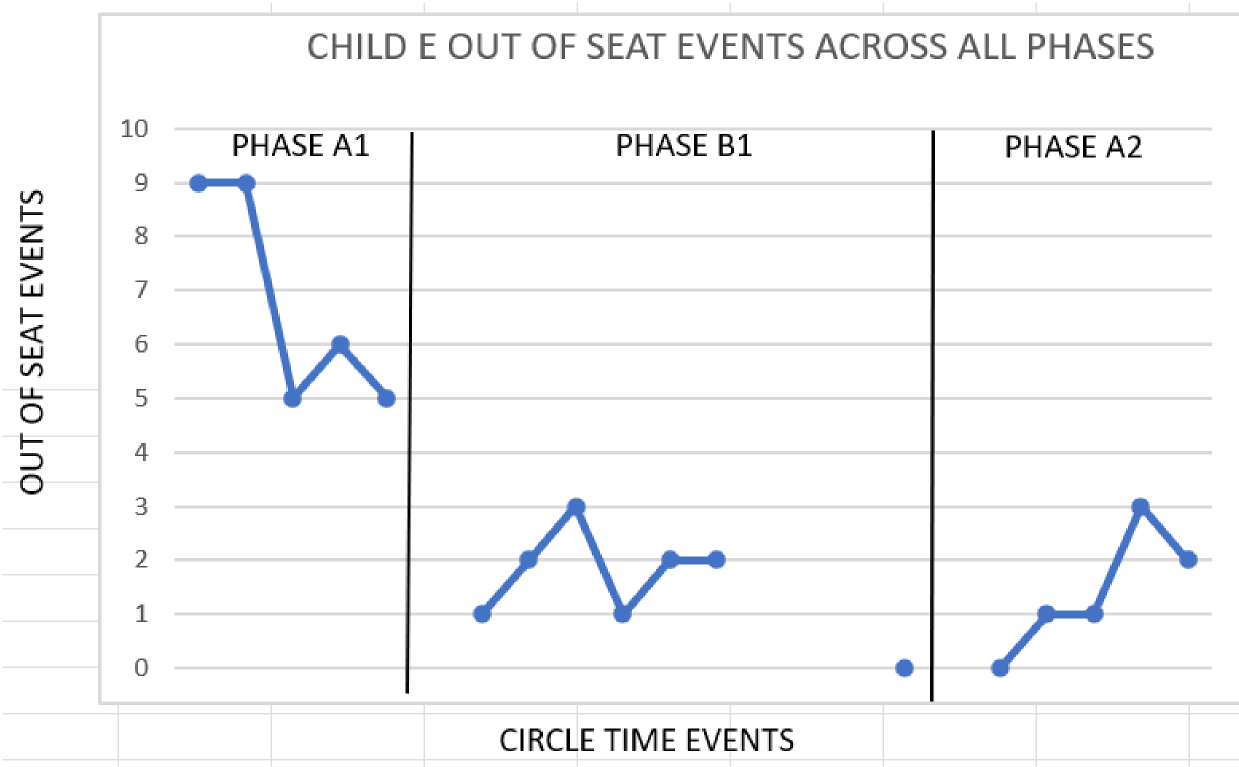
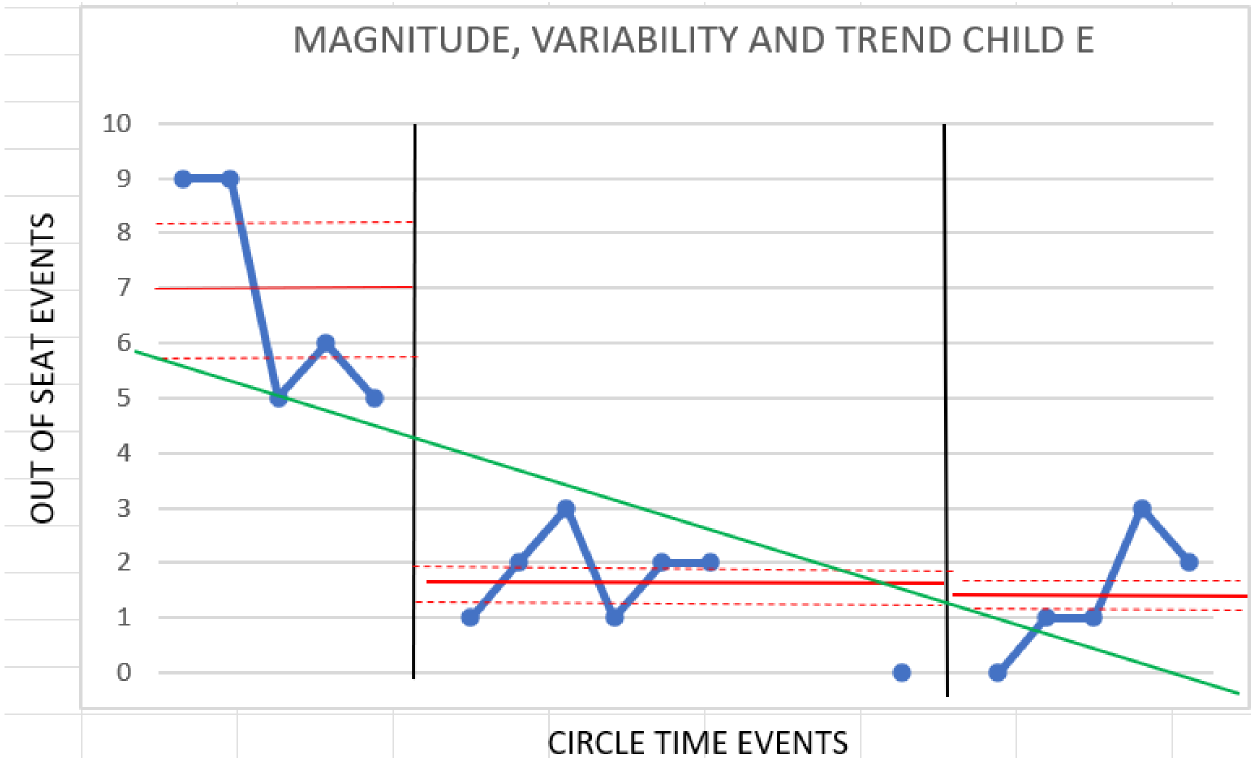


Figure 6 demonstrates the magnitude change of the mean level per phase for child E (solid red line), as well as the variability with a data phase (dashed red line). Variability within a data phase indicates how closely the data points align with the best fit line. In figure 6, Phase A1 and Phase A2 demonstrate a high variability as significantly lower than 80-90% of the data points fall outside the designated boundary. Phase B1 demonstrates a medium to variability as five data points fall outside of the designated boundary and two fall within. The green line on this chart represents the trend line that was calculated using the freehand method (Kennedy, 2005). The magnitude between the end Phase A1 and the beginning Phase B1 is an eighty percent reduction. The trend line indicates a slope of -0.4 indicating a therapeutic deceleration.

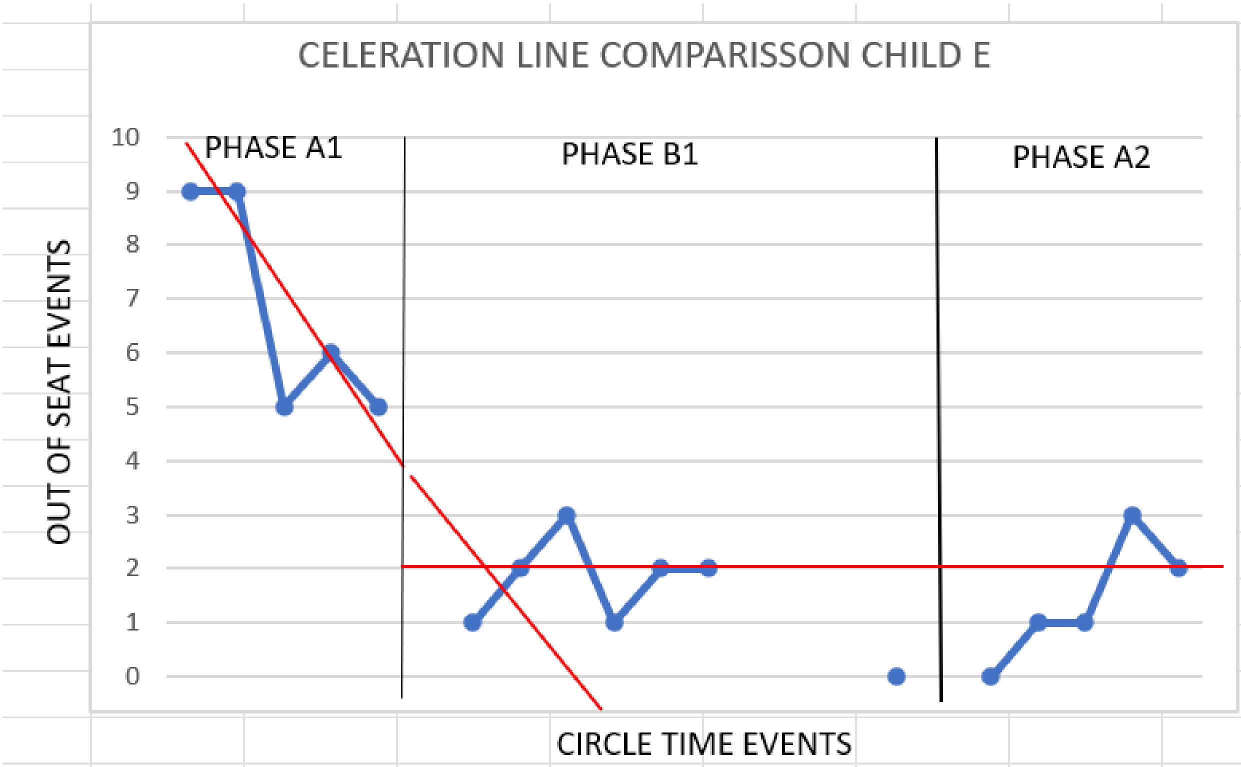
Figure 6: Magnitude, Variability and Trend Child E



The next (figure 7) compares the data across phases (A1-B1 and B1-A2). The celeration lines (red) indicate that intervention phase (B1) created a change as compared to the baseline data (A1). All the intervention data is below that of the celeration line from Phase A1 indicating a therapeutic deceleration. This data is further supported by testing the null hypothesis with a binomial test that investigates if any changes from baseline (A1) to phase B1 is not due to chance. The calculated p-value of the binomial test is 0.003563, and the null hypothesis is accepted (binomial P is less than P .05). The slope of this celeration line is -1.66667, indicating a significant rate of change.

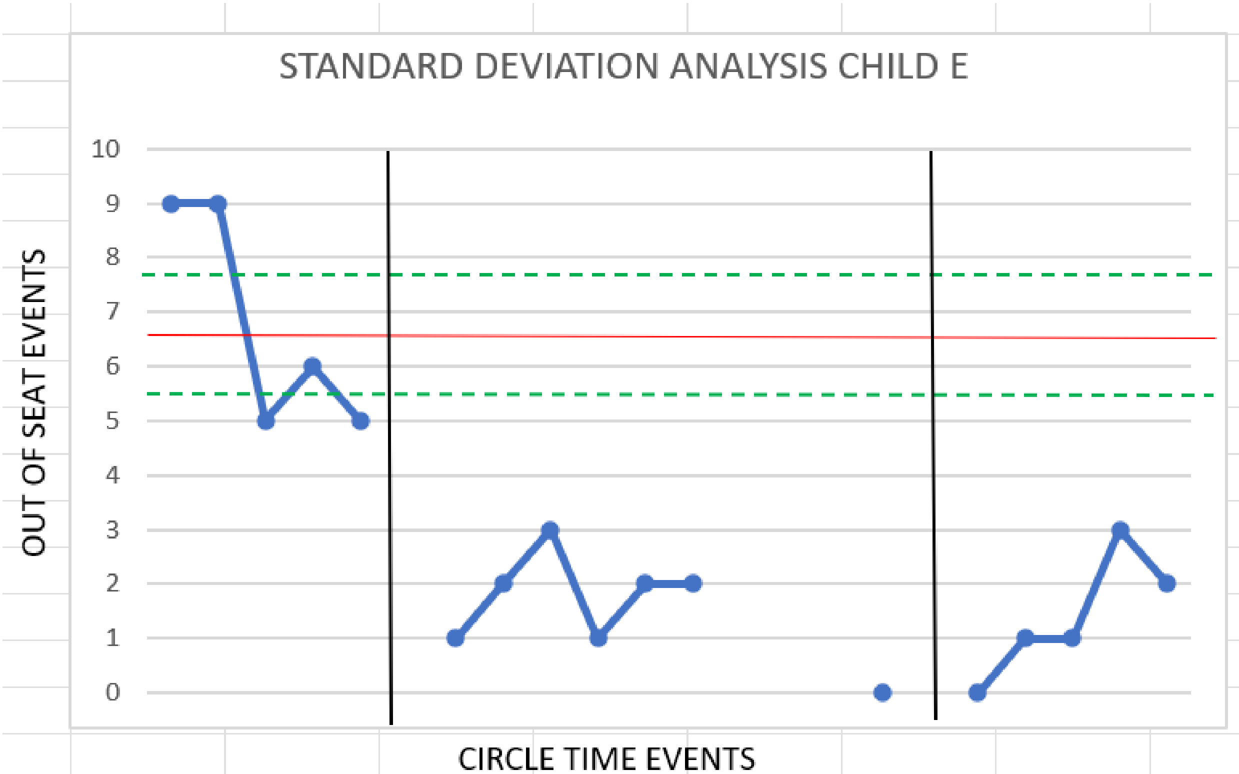
The next calculated celeration line analyzed the trend during Phase B1 and Phase A2. This celeration line was calculated via split line analysis (Kennedy, 2005). The celeration (red) indicates that the out of seat events that were tracked during the withdrawal phase were either equal or above the split baseline data. Binomial analysis of the data yields a p value of 0.203627 which falls above the P=. 05 threshold and rejecting the null hypothesis. The slope of this celeration line is 0, indicating a consistent linear function.

Figure 7: Celeration Line Comparison Child E



The data across all phases was calculated by using 1.5 standard deviation band analysis. In figure 8 the red line indicated the mean and the green dashed lines indicate the upper and lower thresholds of 1.5 standard deviations. In both Phases B1 and A2 only one data point fell within this boundary. The analysis of Phase B1 indicates that 8 of the 9 data points fall -1.5 SD below the mean, indicating a significant decrease in out of seat events during the intervention phase. The analysis of Phase A2 indicates that 2 of the 5 data points fell below -1.5 SD from the mean and 1 of the 5 data point fell above +1.5 SD away from the mean.

Figure 8: Standard Deviation Child E



Visual Analysis of Child F

The visual analysis of Child F (figure 9) demonstrates that there was an increase in out of seat events during Phase A1 from zero to three. Child F was absent on the first day of data collection in phase A1. During Phase B1, Child F demonstrated fluctuations in out of seat events, ranging from zero to three. On day 7 of data collection in Phase B1, the Sensory Path activities could not be used due to severe weather. The data collected in phase A2, demonstrated fluctuation from in out of seat events from zero to four. It should also be noted that child F was absent on day fifteen of data collection.

Figure 9: Out of seat events Child F

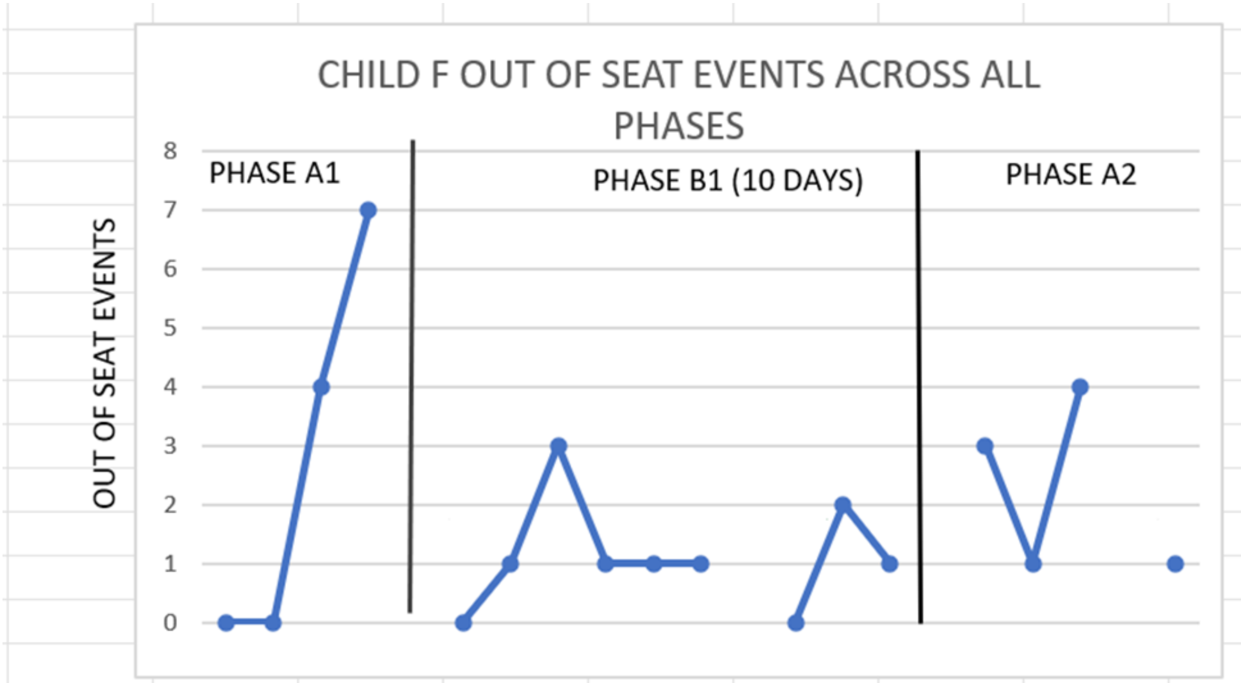


Figure 10 demonstrates the magnitude change of the mean level per phase for child F (solid red line), as well as the variability with a data phase (dashed red line). Variability within a data phase indicates how closely the data points align with the best fit line. In figure 10, Phase A1 and Phase A2 demonstrate a high variability as significantly lower than 80-90% of the data points fall outside the designated boundary. Phase B1 demonstrates a medium variability as five data points fall within the designated boundary and 7.2 would be required for 80% or a low variability. The green line on this chart represents the trend line that was calculated using the freehand method. The magnitude between the end of Phase A1 and the beginning of Phase B1 indicates a one hundred percent reduction. The trend line indicates a slope of -0.0345625 indicating a therapeutic deceleration.

Figure 10: Magnitude, Variability, Trend Child F

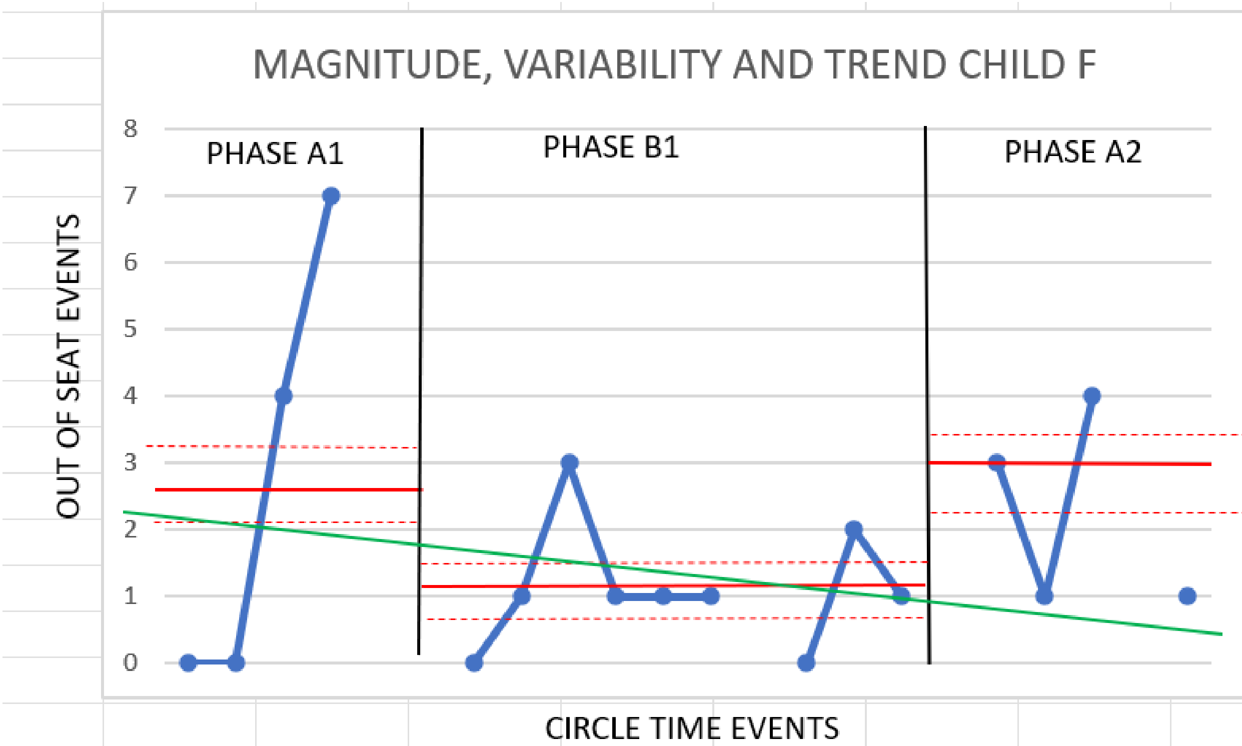
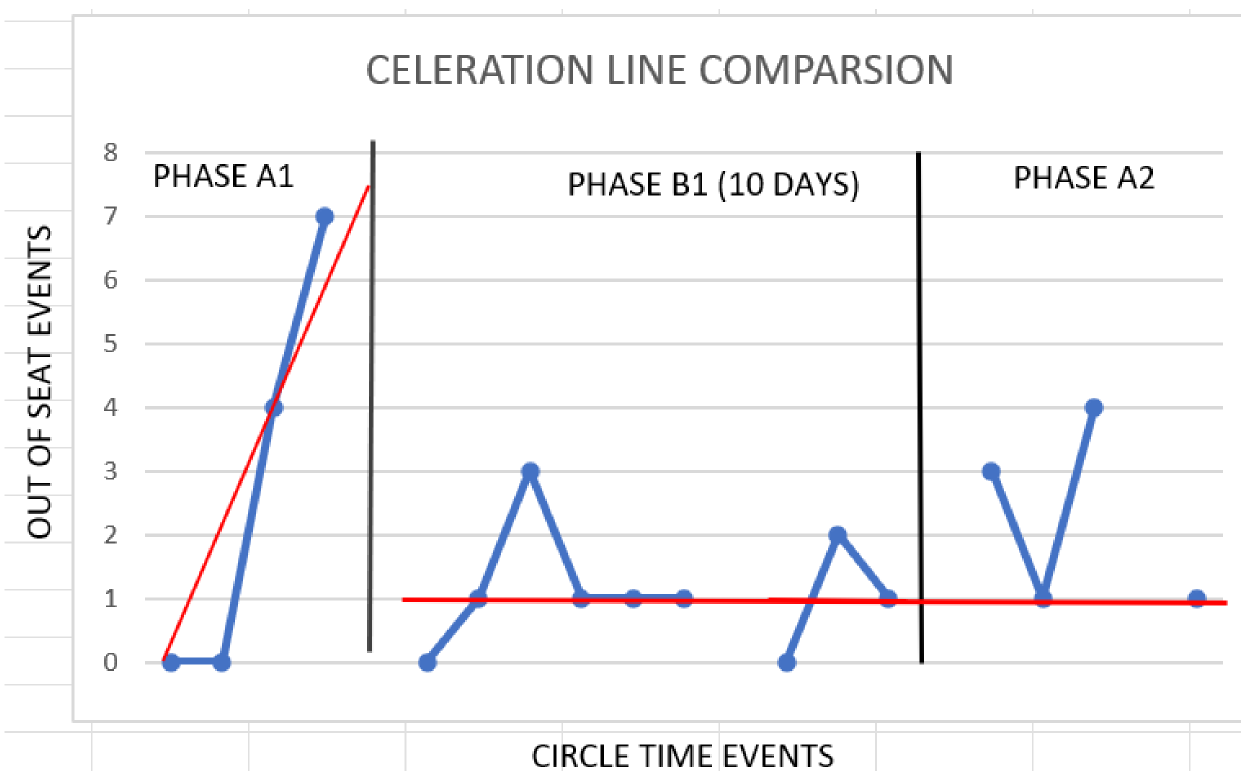


Figure 11 compares the data across phases (A1-B1 and B1-A2). The celeration lines (red) indicate that intervention phase (B1) created a change as compared to the baseline data (A1). All the intervention data is below that of the celeration line from Phase A1 indicating a therapeutic deceleration. This data is further supported by testing the null hypothesis with a binomial test that investigates if any changes from baseline (A1) to phase B1 is not due to chance. The calculated p-value of the binomial test is 1.953, and the null hypothesis is not accepted (greater than P .05). The slope of this celeration line is 1.33, indicating a significant rate of change.

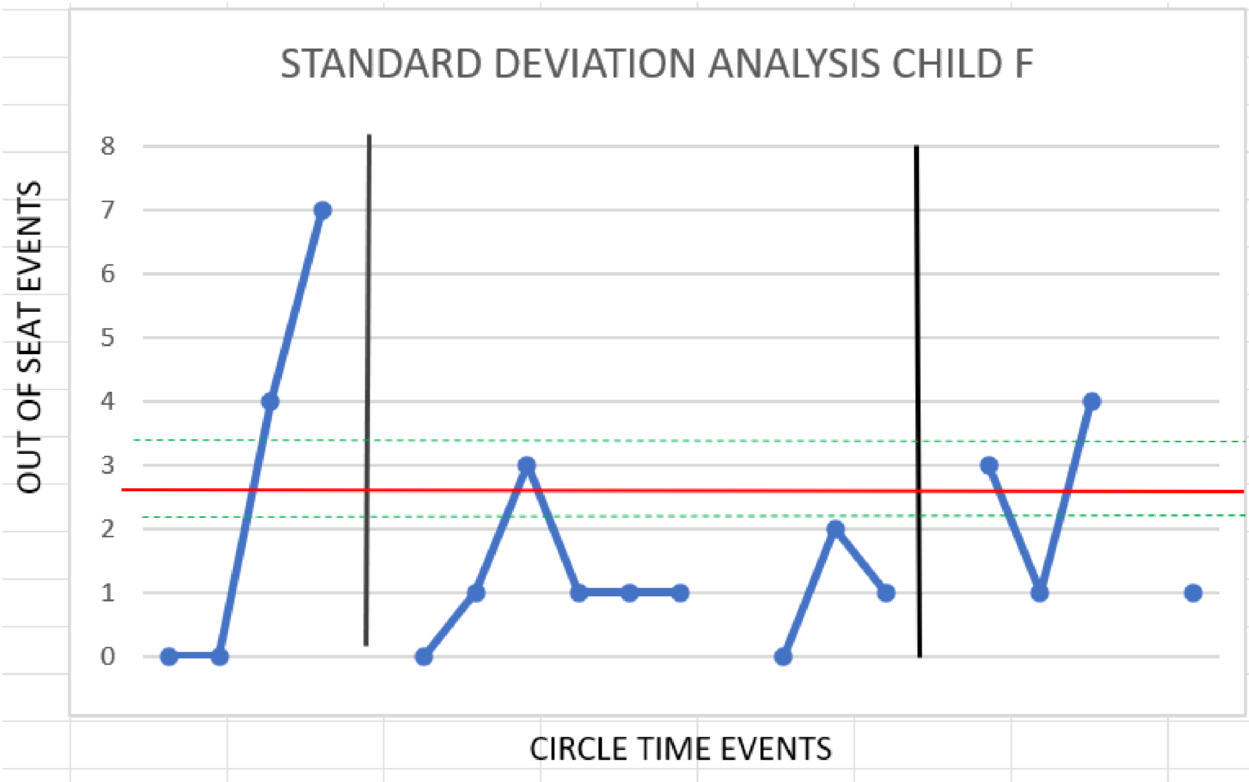
The next calculated celeration line analyzed the trend during Phase B1 and Phase A2. This celeration line was calculated via split line analysis. The celeration (red) indicates that the out of seat events that were tracked during the withdrawal phase were either equal or above the split baseline data. Binomial analysis of the data yields a p value of 0.013538 which falls below the p.05 threshold indicating significance. The slope of this celeration line is 1, indicating a consistent linear function.

Figure 11: Celeration Line Comparison Child F



The data across all phases was calculated by using 1.5 standard deviation band analysis. In figure 12, the red line indicated the mean and the green dashed lines indicate the upper and lower thresholds of 1.5 standard deviations. In Phases B1 only 1 out of the 9 data points fell within the designated boundary, the remaining eight fell -1.5 SD below the mean, indicating a significant decrease in out of seat events during the intervention phase. The analysis of Phase A2 indicates that 1 of the 4 data points fell within the designated boundary, two fell below -1.5 SD from the mean and 1 of the 5 data point fell above +1.5 SD away from the mean.

Figure 12: Standard Deviation Child F



Visual Analysis of Child G

The visual analysis of child G (see figure 13) demonstrates that there was a plateau of out of seat events during Phase A1 remaining at 1. Child G was absent on the first and second day of data collection in phase A1, therefore only three days were collected. Child G was present for all circle time events in Phase B1, Child G demonstrated limited fluctuations in out of seat events, 8 out of 10 data collection points maintained zero. On day 7 of data collection in Phase B1, the Sensory Path activities could not be used due to severe weather. Child G demonstrated 1 out of seat event on day 9 in Phase B1. Child G was present for the data collected in phase A2. Child G demonstrated fluctuation from in out of seat events from zero to two.

Figure 13: Out of seat events Child G

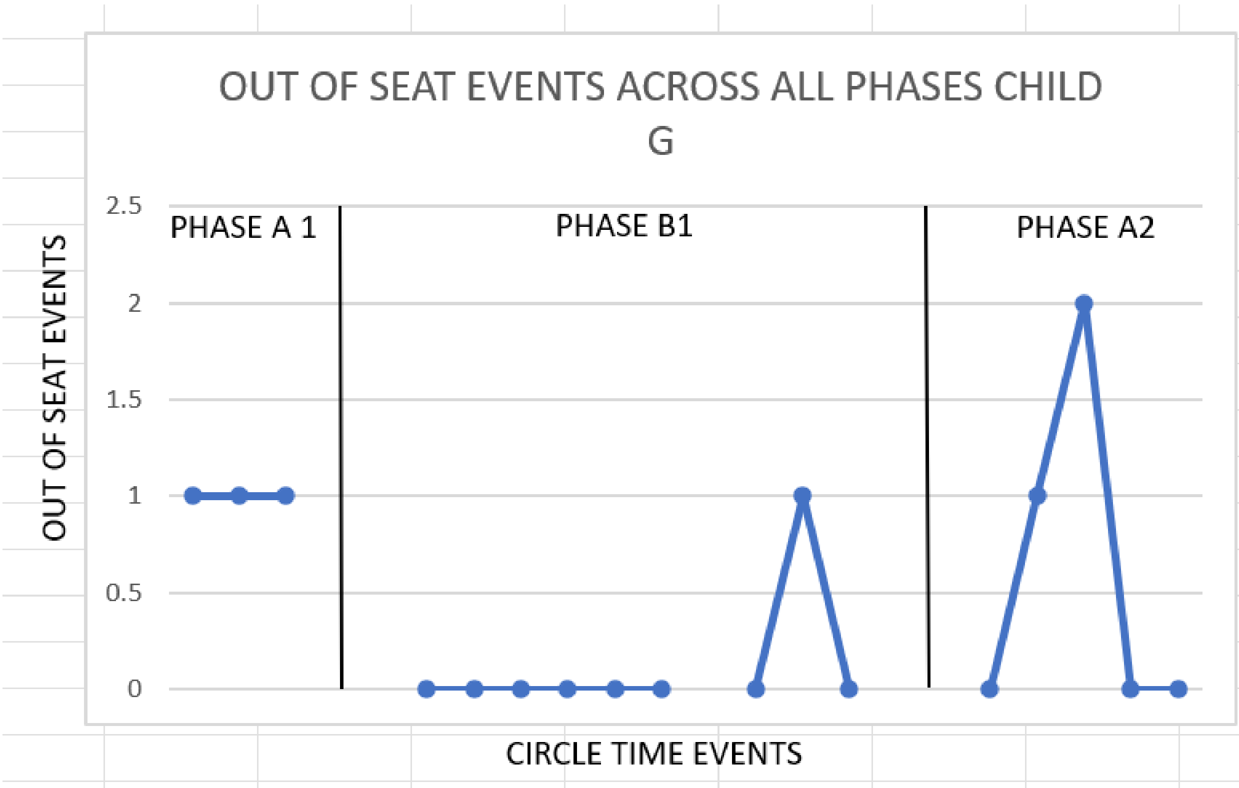


Figure 14 demonstrates the magnitude change of the mean level per phase for child G (solid red line), as well as the variability within a data phase (dashed red line). Variability within a data phase indicates how closely the data points align with the best fit line. In figure 14, Phase A1 demonstrated a low variability as all the data points fell within the designated boundary. Where Phase B1and Phase A2 demonstrate a high variability as significantly greater than 80-90% of the data points fall outside the designated boundary. The green line on this chart represents the trend line that was calculated using the freehand method. The magnitude between the end of Phase A1 and the beginning of Phase B1 indicates a one hundred percent reduction. The trend line indicates a slope of -0.0083333 indicating a therapeutic deceleration.

Figure 14: Magnitude, Variability and Trend Child G

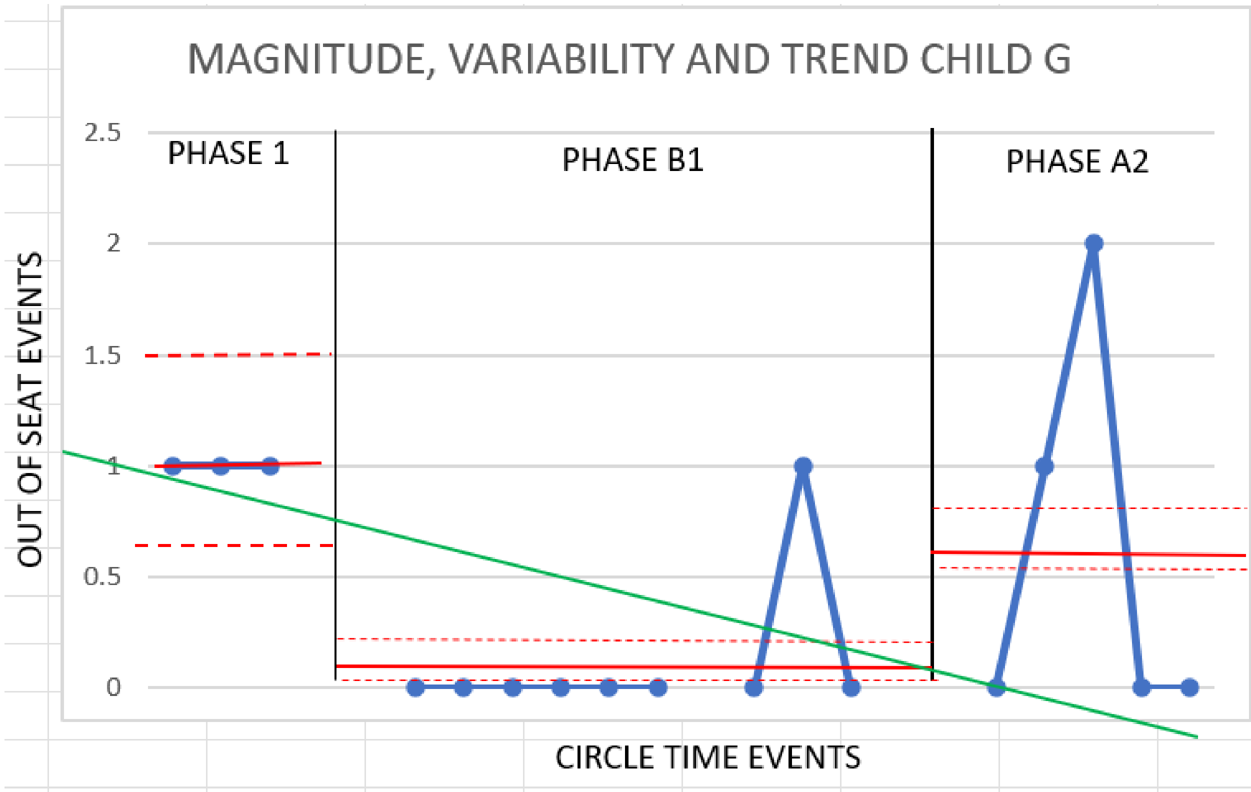
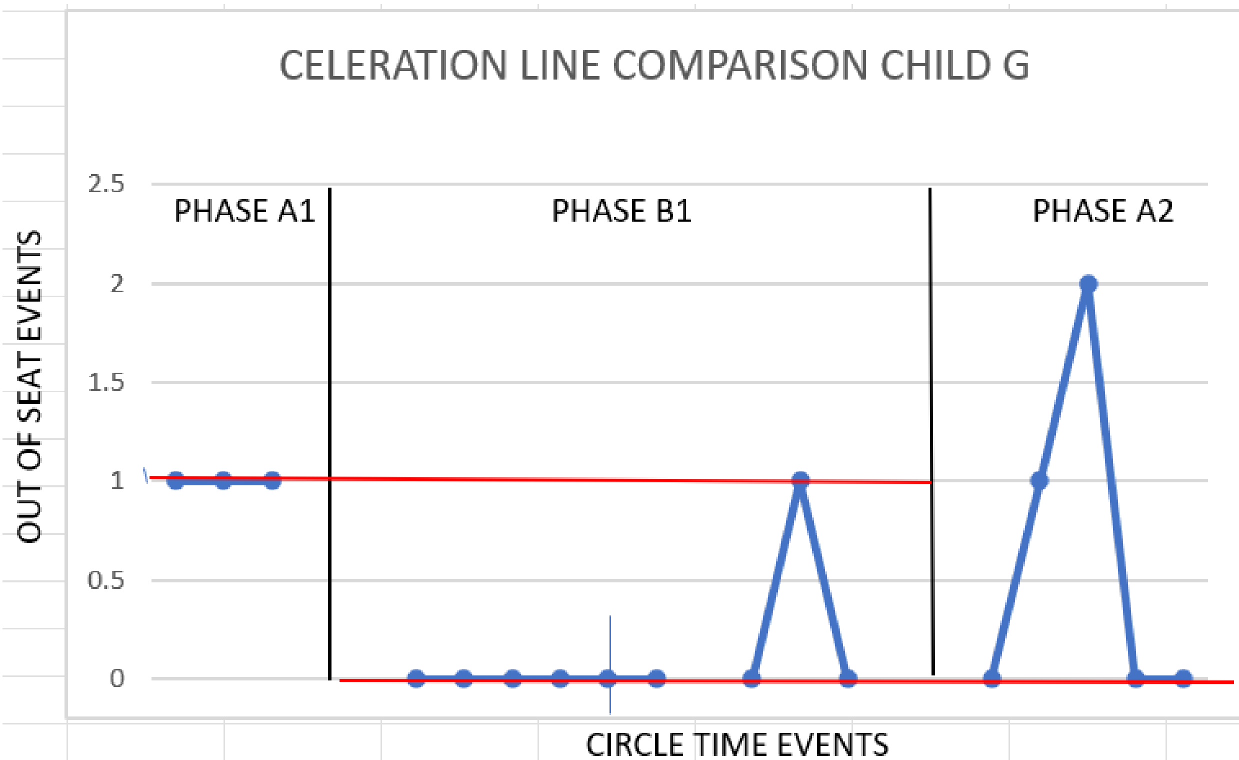


Figure 15 compares the data across phases (A1-B1 and B1-A2). The celeration lines (red) indicate that intervention phase (B1) created a change as compared to the baseline data (A1). All the intervention data is at or below that of the celeration line from Phase A1, as determined by the split middle line indicating a therapeutic deceleration. This data is further supported by testing the null hypothesis with a binomial test that investigates if any changes from baseline (A1) to phase B1 is not due to chance. The calculated p-value of the binomial test is 1.953, and the null hypothesis is not accepted (greater than P .05). The slope of this celeration line is 0, indicating a linear function.

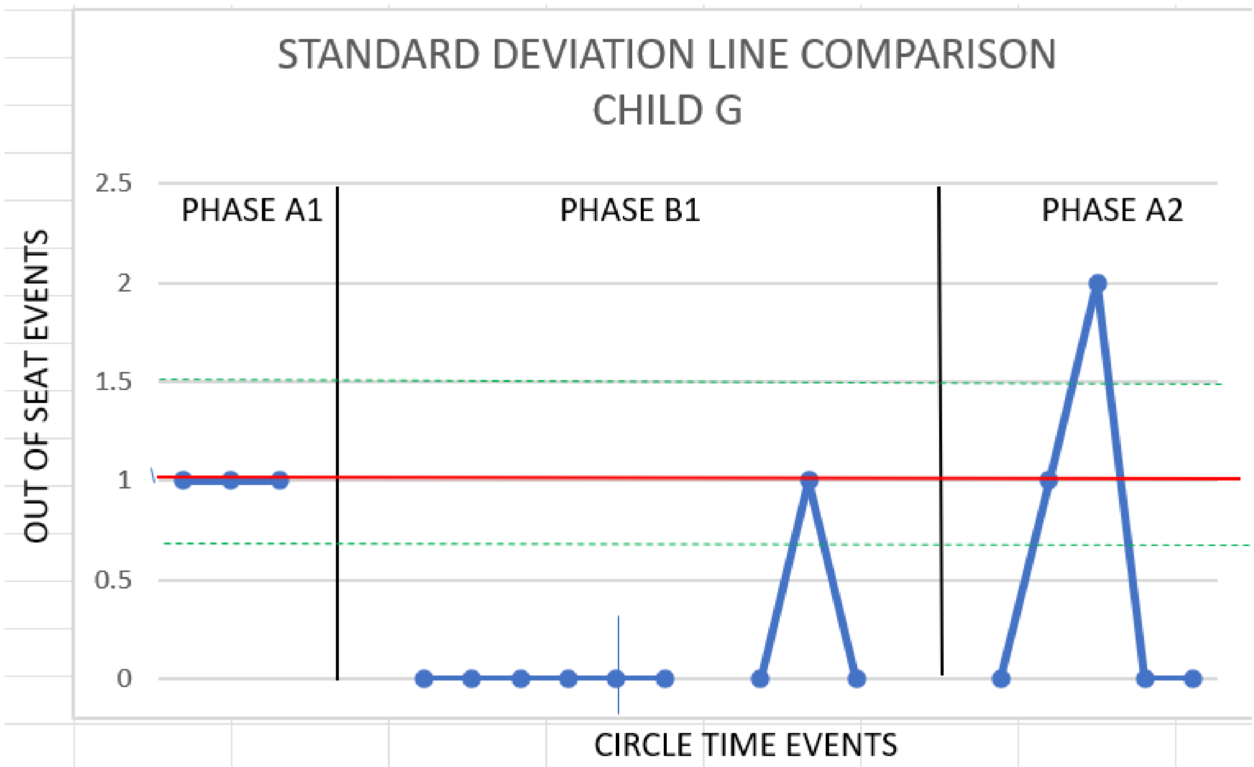
The next calculated celeration line analyzed the trend during Phase B1 and Phase A2. This celeration line was calculated and compared to the Phase A2 via split line analysis. The celeration (red) indicates that the out of seat events that were tracked during the withdrawal phase were either equal or above the split baseline data. Binomial analysis of the data yields a p value of 0.0423 which falls below the p.05 threshold indicating significance and the null hypothesis is accepted. The slope of this celeration line is 0, indicating a consistent linear function.

Figure 15: Celeration Line Comparison Child G



The data across all phases was calculated by using 1.5 standard deviation band analysis. In figure 16, the red line indicated the mean and the green dashed lines indicate the upper and lower thresholds of 1.5 standard deviations. In both Phases B1 and A2 only one data point fell within this boundary. The analysis of Phase B1 indicates that 8 of the 9 data points fall -1.5 SD below the mean, indicating a significant decrease in out of seat events during the intervention phase. The analysis of Phase A2 indicates that 2 of the 5 data points fell below -1.5 SD from the mean and 1 of the 5 data point fell above +1.5 SD away from the mean.

Figure 16: Standard Deviation Child G



Visual Analysis of Child H

The visual analysis of Child H (see figure 17) demonstrates that Child H was present for all the data collection events in Phase A1. Child H indicates fluctuations of out of seat events during Phase A1 from one to eight. During Phase B1, there was a fire drill on day four and Child H was absent on day five of the second phase of data collection. On day seven of Phase B the Sensory Paths could not be used due to severe weather. There was a total of seven out of ten data collection points. During Phase B1, Child H demonstrated fluctuations in out of seat events ranging from one to four. During Phase A2, Child H was absent on the 5th day of data collection. Child H demonstrated fluctuations in out of seat events during Phase A2 ranging from one to five.

Figure 17: Out of seat events Child H

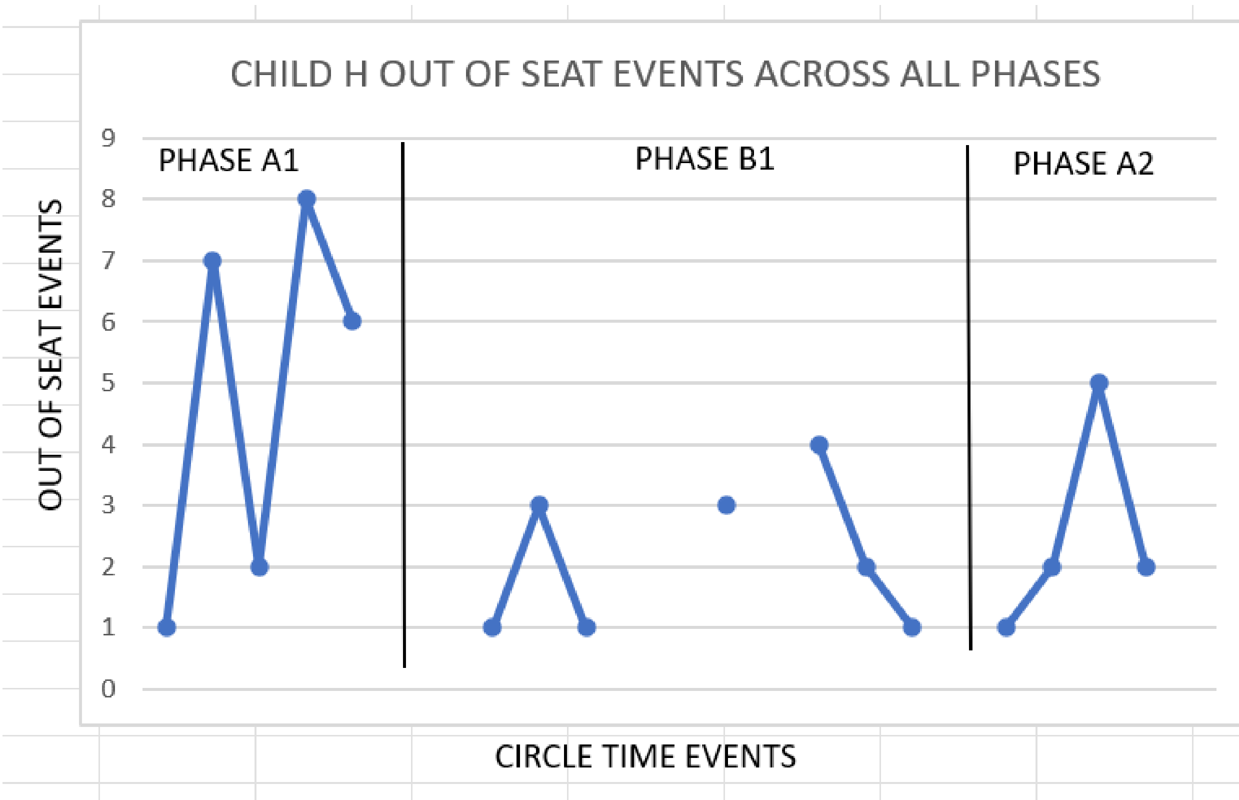


Figure 18 demonstrates the magnitude change of the mean level per phase for child H (solid red line), as well as the variability within a data phase (dashed red line). Variability within a data phase indicates how closely the data points align with the best fit line. In figure 18, Phases A1, B1, and A2 demonstrated low variability as all or most of the data points fell outside the designated boundary. The green line on this chart represents the trend line that was calculated using the freehand method. The magnitude between the end of Phase A1 and the beginning of

Phase B1 indicates an eighty-three percent reduction. The trend line indicates a slope of -0.375 indicating a therapeutic deceleration.

Figure 18: Magnitude, Variability and Trend Child H

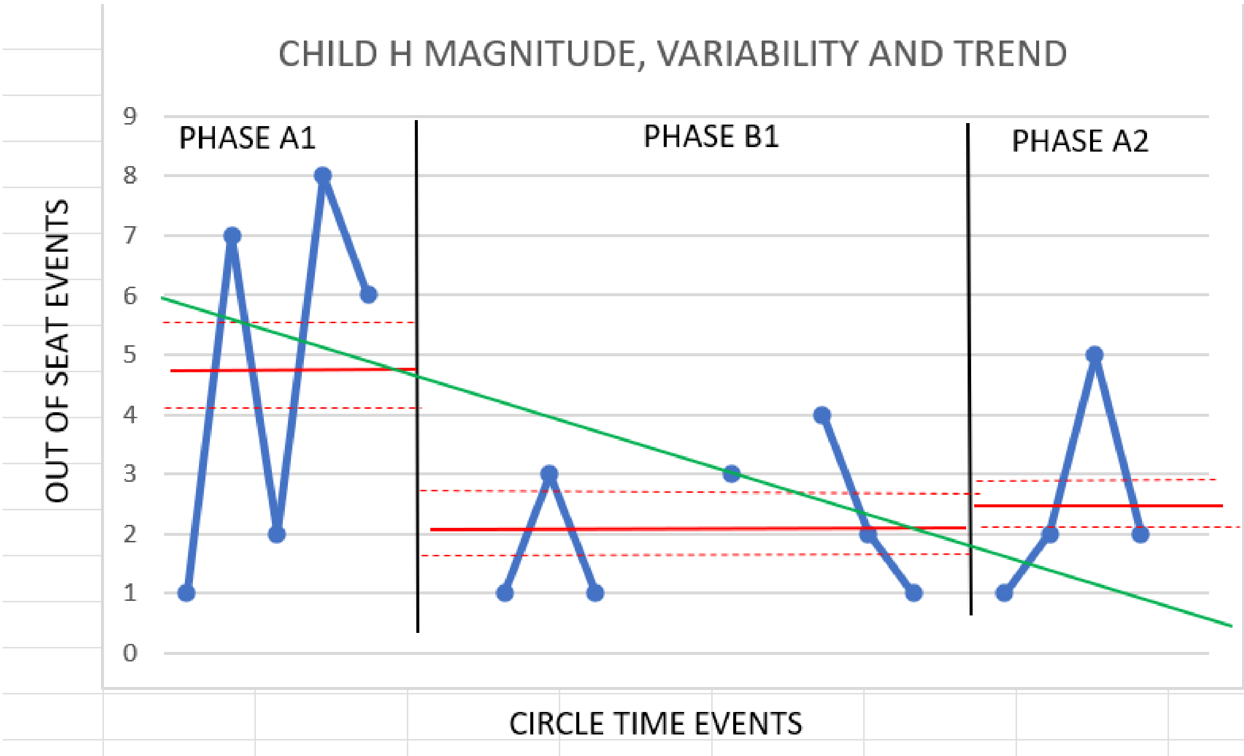
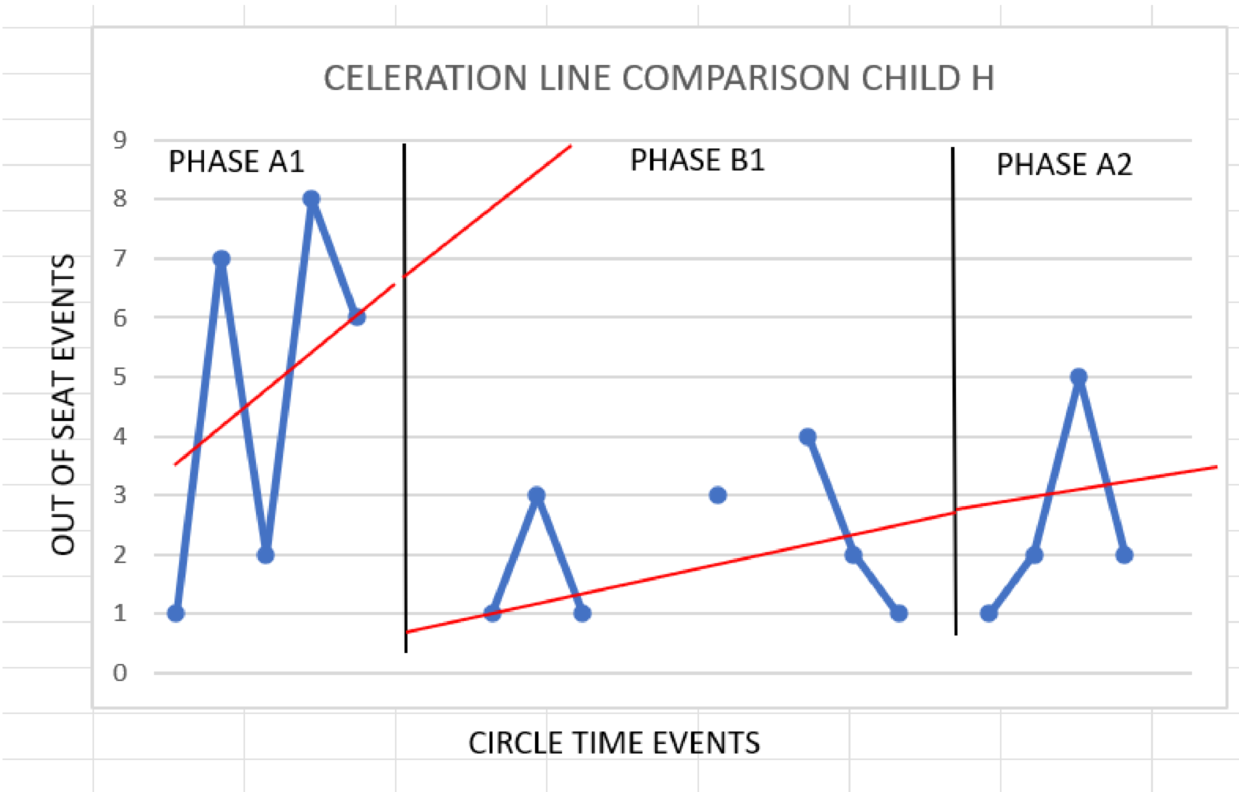


Figure 19 compares the data across phases (A1-B1 and B1-A2). The celeration lines (red) indicate that intervention phase (B1) created a change as compared to the baseline data (A1). All the intervention data in Phase B1 is below that of the celeration line from Phase A1, as determined by the split middle line indicating a therapeutic deceleration. This data is further enhanced by testing the null hypothesis with a binomial test that investigates if any changes from baseline (A1) to phase B1 is not due to chance. The calculated p-value of the binomial test is 7.81, and the null hypothesis is not accepted (greater than P .05). The slope of this celeration line is .64, indicating an accelerating trend.

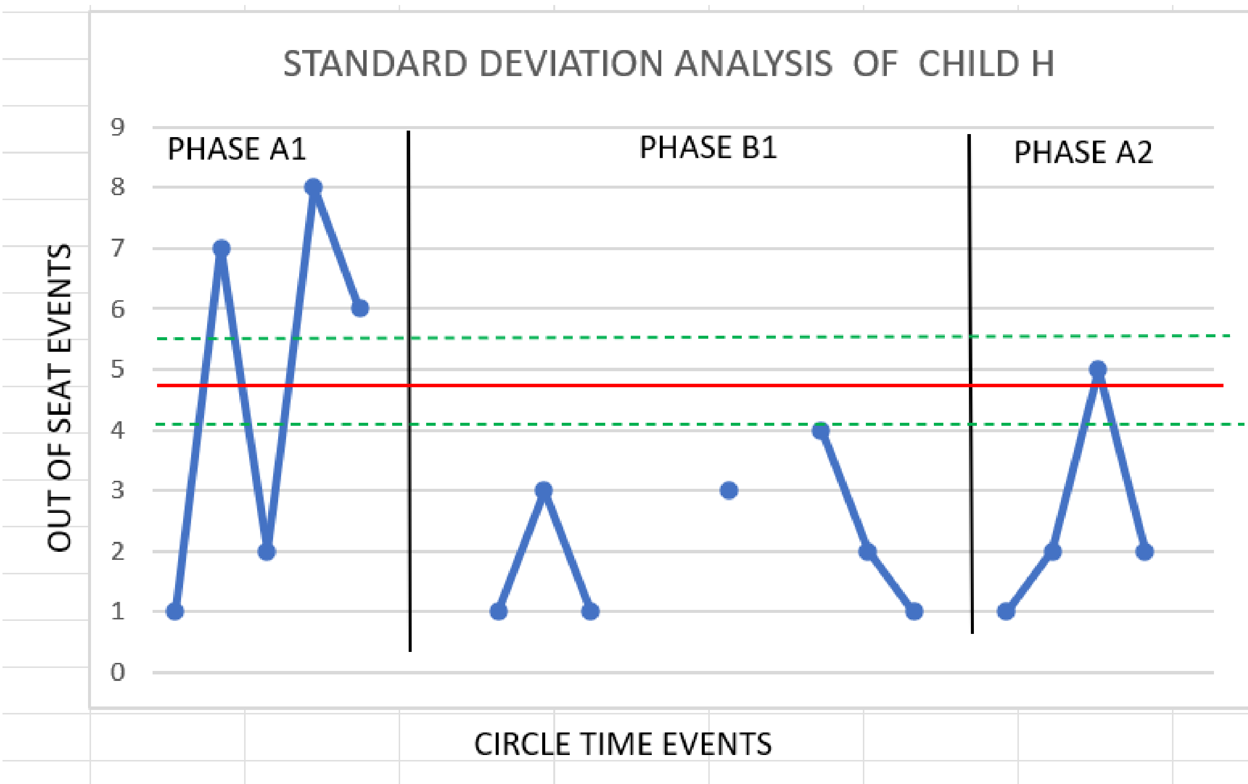
The next calculated celeration line analyzed the trend during Phase B1 and Phase A2. This celeration line was calculated and compared to the Phase A2 via split line analysis. The celeration (red) indicates that the out of seat events that were tracked during the withdrawal phase were either equal or above the split baseline data. Binomial analysis of the data yields a p value of 0.135375 which falls above the p.05 threshold indicating the null hypothesis is not accepted. The slope of this celeration line is .25, indicating an accelerating linear function.

Figure 19: Celeration Line Comparison Child H



The data across all phases was calculated by using 1.5 standard deviation band analysis. In figure 20 the red line indicated the mean and the green dashed lines indicate the upper and lower thresholds of 1.5 standard deviations. All the data points in Phase A1 fell outside of the designated boundary (three above and two below). The data points of Phase B1 all fell -1.5 SD below the mean, indicating a significant decrease in out of seat events during the intervention phase. One data point in Phase A2 fell within the designated boundary, the other three points fell -1.5 SD below the mean.

Figure 20: Standard Deviation Child H



Visual Analysis of Child I

The visual analysis of child I (see figure 21) demonstrates that there was a plateau of out of seat events during Phase A1, four of the 5 data points tracked remained at zero and one data point was at one. Child I was present for all circle time events in Phase B1; however, data was not collected during two days of Phase B1. There was a fire drill on day 4 of Phase B1 and on day 7 of data collection in Phase B1, the Sensory Path activities could not be used due to severe weather. Child I demonstrated an increase in out of seat events during Phase B1 immediately after the fire drill and weather events. It was noted in the fieldnotes that Child I found these events particularly distressing as evidenced by crying, holding his ears and becoming agitated. During Phase B1 the out of seat events by Child I ranged from three to five. During Phase A2, Child I demonstrated significant fluctuations in out of seat events ranging from one to five.

Figure 21: Out of seat events Child I

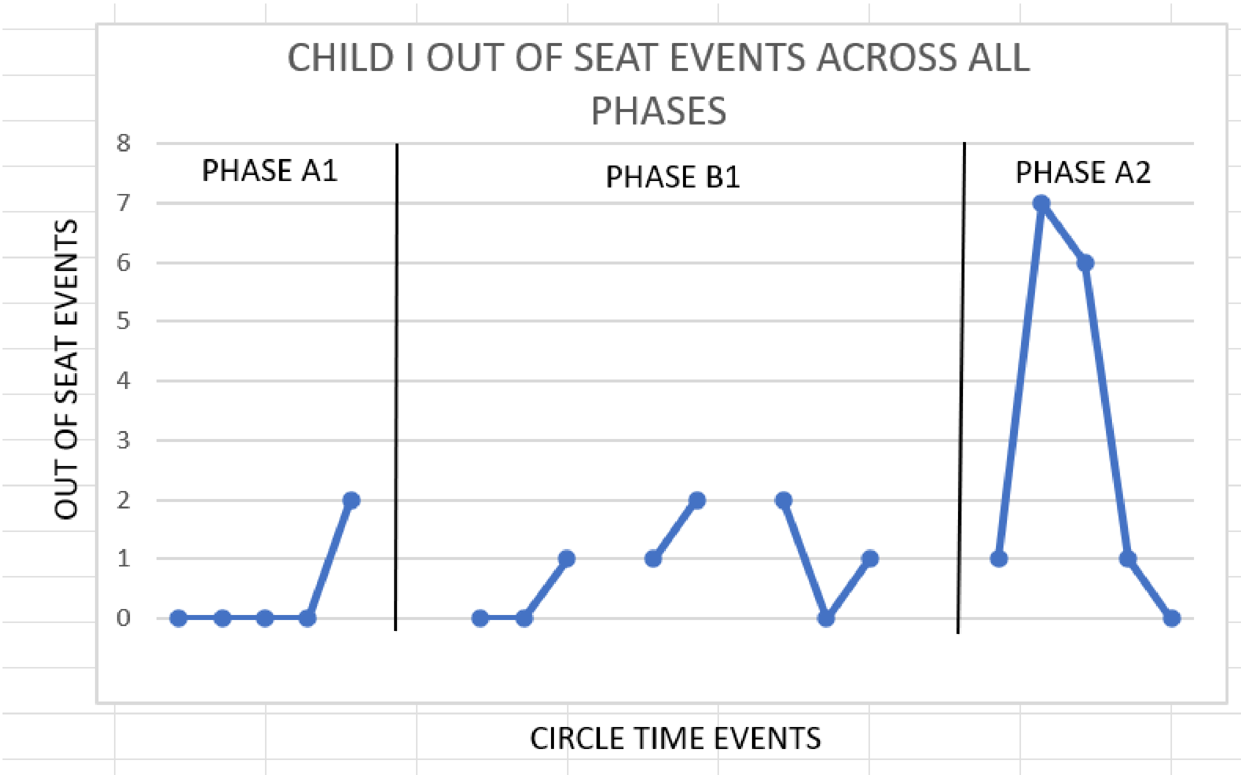


Figure 22 demonstrates the magnitude change of the mean level per phase for child I (solid red line), as well as the variability within a data phase (dashed red line). Variability within a data phase indicates how closely the data points align with the best fit line. In figure 22, Phase A1 and A2, demonstrated a high variability as all the data points (significantly greater than 80-90% of the data points) fall outside the designated boundary. Phase B1 demonstrate moderate level of variability as four data points remained inside the designated boundary and five fell outside. The green line on this chart represents the trend line that was calculated using the freehand method. The magnitude between the end of Phase A1 and the beginning of Phase B1 indicates a one hundred percent reduction. The trend line indicates a slope of -0.08333 indicating a slight therapeutic deceleration.

Figure 22: Magnitude, Variability, and Trend Child I

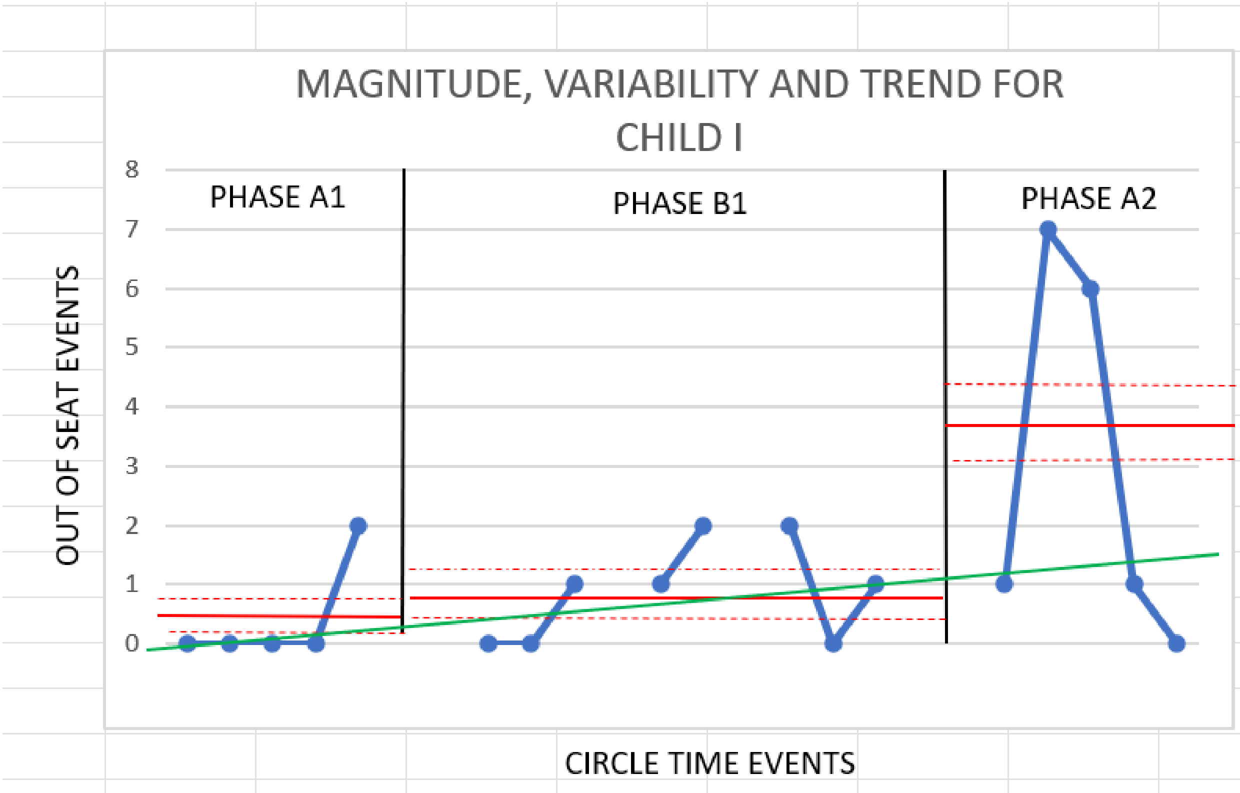
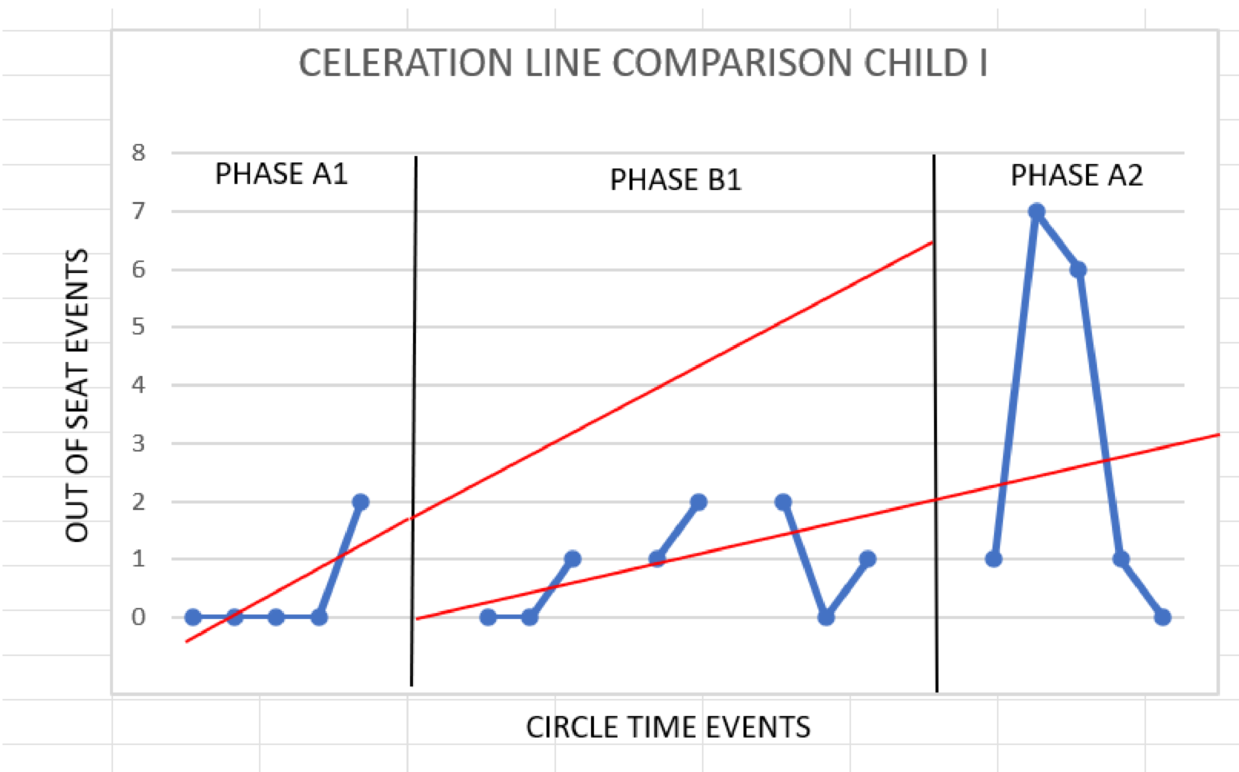


Figure 23 compares the data across phases (A1-B1 and B1-A2). The celeration lines (red) indicate that intervention phase (B1) created a change as compared to the baseline data (A1). All the intervention data is below that of the celeration line from Phase A1, as determined by the split middle line indicating a therapeutic deceleration. This data is further supported by testing the null hypothesis with a binomial test that investigates if any changes from baseline (A1) to phase B1 is not due to chance. The calculated p-value of the binomial test is 1.953, and the null hypothesis is not accepted (greater than P .05). The slope of this celeration line is .5, indicating an accelerated function.

The next calculated celeration line analyzed the trend during Phase B1 and Phase A2. This celeration line was calculated and compared to the Phase A2 via split line analysis. The celeration (red) indicates that the out of seat events that were tracked during the withdrawal phase were either equal or above the split baseline data. Binomial analysis of the data yields a p value of 0.02143 which falls below the p.05 threshold indicating significance and the null hypothesis is accepted. The slope of this celeration line is 1, indicating a consistent linear function.

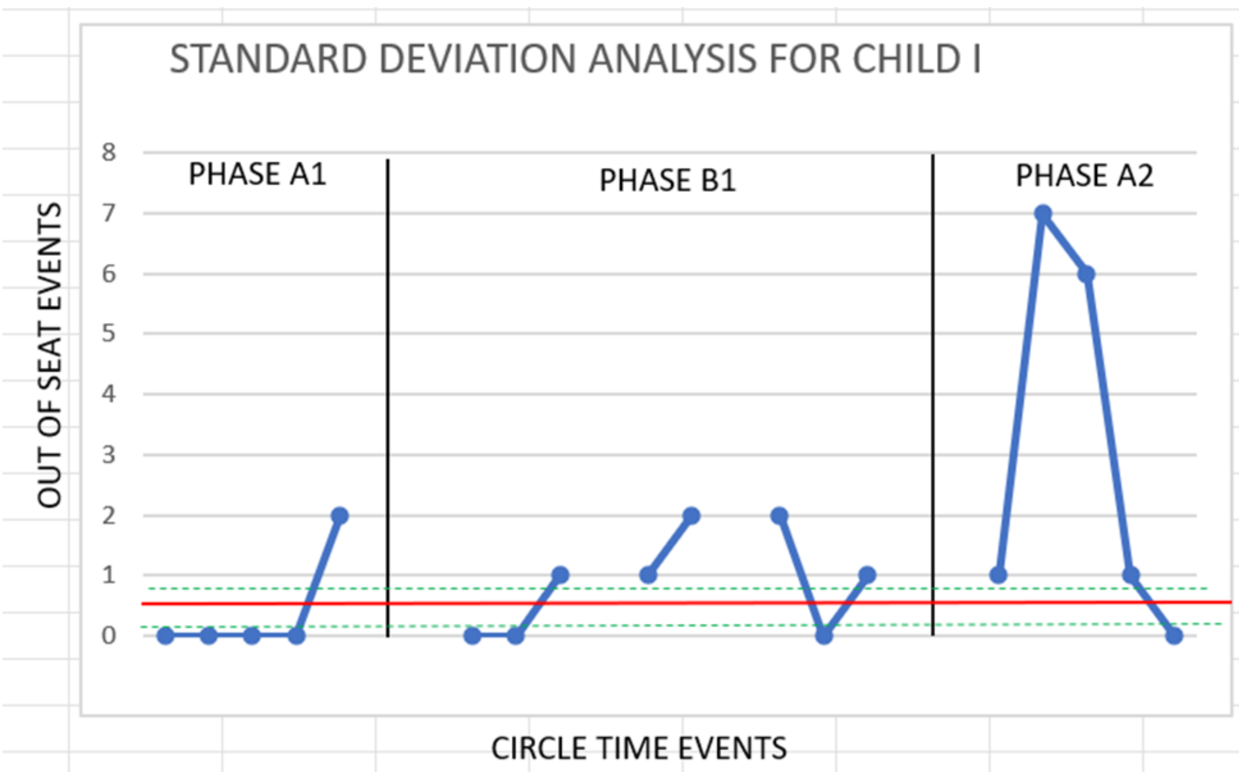
Figure 23: Celeration Line Comparison Child I



The data across all phases was calculated by using 1.5 standard deviation band analysis. In figure 24 the red line indicated the mean and the green dashed lines indicate the upper and lower thresholds of 1.5 standard deviations. All the data points across all three phases fell outside the designated boundary. In Phase A1 four of the data points were -1.5 SD below the mean and one data point was +1.5 SD above the mean. In Phase B1 three data points were -1.5

SD below the mean and four data point were +1.5 SD above the mean. In phase A2 only one data point was -1.5 SD below the mean and four data points were +1.5 SD above the mean, both Phases B1 and A2 only one data point fell within this boundary. Interpretation of this analysis indicates that it is unclear if the intervention caused a change as the mean for the baseline was 0.4, a low baseline threshold when anticipating therapeutic deceleration.

Figure 24: Standard Deviation Child I



Fieldnote Observations

The fieldnotes for Phase A1 included descriptions of the people involved, classrooms and the structure of the circle times. Initially, the teachers expressed concerns regarding the participation of the class but were hopeful and motivated to participate. A summary of fieldnotes for the second week (Phase B1) revealed that the teachers were surprised how easy the implementation of the Sensory Path intervention was and how quickly the children learned the simple movements (walking along the path at a quick pace). Additionally, it was noted that all of the participants were able to complete the Sensory Path activity for the minimum of 10 minutes for all recorded days. Recorded fieldnotes for week three (Phase B1) indicated that the recorders, as well as teachers, observed the children walking, jumping and performing animal movements on the Sensory Paths without adult intervention or encouragement. It is noted that these movements were more complex than the movements required by the Sensory Path intervention (walking along the path at a quick pace). Additionally, the children were also observed to seek out peers from the class to engage with them along the sensory paths. During week 3 (Phase B1) there was a significant storm including thunder and lightning. Due to the severe weather the children were not permitted to go out and complete the Sensory Path activity. Therefore, data collection on that day was out of seat events during circle time without the Sensory Path intervention. In addition to the storm, during the second week of Phase B1, there were several extraneous variables that made an impact on the classes. Fire drills and lockout drills were conducted that week. These events were preceded by an overhead announcement and support staff that were unknown to the children entered the classroom to assist. Several children were observed demonstrated distressed during these events (crying, holding their ears, agitation). Additionally, classroom D got a new child who demonstrated difficulties separating from his caregiver. Despite these variables, the raters and the teachers observed that the duration and intensity of out of seat events were less intense or shorter in duration compared to the first week (A1). Teachers used terms like, “They had a good day” or “The child got the question correct” or “followed along with a song”, or “It has been worse” when describing their perceptions of the circle time anecdotally. There were limited observations recorded in the fieldnotes for week four (A2).

Discussion

The results indicate that the Sensory Paths had a positive effect on out of seat events in preschool children with special needs ages three through five. Of the five children who were able to participate in the full study, all demonstrated a decrease in out of seat events as well as therapeutic decleration from Phase A1 to week 1 of Phase B1. Although all the participants demonstrated a slight increase in out of seat events in week 2 of Phase B1, they remained below the baseline data. Between Phase B1 and Phase A2 all the participants demonstrated a therapeutic acceleration, or increased number of out of seat events. The data collected in Phase A2 indicated that four out of the five children's out of seat events remained below their baseline. This supports the literature that suggests sensory-motor based interventions can decrease out of seat events and improve attention (Ashburner et al., 2008; Baranek, 2002; Bodison & Parham, 2017; Case-Smith & Arbesman, 2008; Hodgetts & Hodgetts, 2007). This reduction in out of seat events supports the literature that neural changes can be made in the brain that can affect inhibition of behavior, the ability to wait or the persistence required for completing a task or activity (Jacob & Nienborg, 2018; Lottem et al.,2018; Miyazaki et al., 2014) as well as improve attention (Ashburner et al., 2008; Bittner et al, 2018; Koziol et al., 2011).

As indicated in the fieldnotes, the second week of Phase B1 had numerous events, that could not be controlled, that could negatively affect the out of seat events during circle time. Extraneous variables experienced in this research project included fire drills, lockout drills, severe weather, specials such as pet therapy/firetruck day and quarantining due to COVID. In addition, the amount of traffic going in and out of the classroom from service providers taking their children to and from their therapies was not anticipated and disruptive. Fire drills, lock out/in drills forced the classrooms to change their circle times. Therefore, the data collectors had to keep changing the collection schedule and ensure that no more than 2 classes were engaging in circle time contemporaneously. Student absences were anticipated; however, two classes (4 participants) being quarantined due to COVID was not anticipated. The teachers reported that they felt as though the Sensory Paths were effective in decreasing the intensity of out of seat events and improved attention.

In preparation for this capstone project, during the applied leadership experience, the teachers and teaching assistants were educated on the use of the Sensory Paths. This training included the necessity for collaboration between the teacher, assistant and the occupational therapist as well as a variety of different movement experiences that could be completed on the Sensory Paths, ranging from very simple (just walking at a quick pace) to more complex (jumping, turning, and animal walks). The expectation for this capstone project was that the classes would participate in the simplest/noncomplex movements, walking along the Sensory Paths at a brisk pace. Astonishingly, before the end of the first week of the intervention phase of the study, the children, on their own during recess, started to perform the more complex movements that were indicated by the markers on the Sensory Paths. The children spontaneously began to complete movements such as jumping and turning to the left, jumping and turning to the right, and frog jumps, without adult intervention, just by looking at the indicators on the Sensory Paths and watching peers. This supports the evidence that the movements incorporated into the Sensory Path activities are associated with typical playground play and components of Sensory Diets and can meet the sensory needs in children during the classroom day, providing a richer classroom experience than just individual therapy alone (Nackley, 2001; Sahoo and Senapati, 2014).

Fieldnotes also indicated that the teachers were surprised regarding how easy the intervention was to implement. Prior to the project, the teachers had concerns regarding challenges with transitions between the Sensory Paths and the circle time, especially since this was a change in the classroom routine. The easy implementation of the Sensory Paths was encouraging to the teachers and kept them motivated to continue. Motivation, time constraints and lack of training were reported in the literature as barriers to teacher/occupational therapist collaboration. The Sensory Path project recognized that and took these barriers into account when implementing the project (Mills, & Chapparo, 2017; Wilson & Harris, 2017). Before the training, teachers reported being unaware of what the painted markers (used to guide the movements of the children during the implementation of the Sensory Paths) on the playground were and what their purpose was. The teachers embraced the collaboration between themselves and the occupational therapists during the Sensory Path project. The teachers were very open and receptive to the suggestions of the occupational therapists about the implementation of the Sensory Paths. Despite trainings, the teachers had many specific questions, such as, why will this help the children? How will this help the children? Do we have to walk in this order? These questions were answered by the primary investigator and review of the Sensory Path manual created during the Applied Leadership Experience in the summer of 2021. This supports the literature that teachers may view the management of sensory seeking events, such as out of seat events, as the role of the occupational therapist (Mills and Chapparo, 2017). Thus, occupational therapists are well suited to collaborate with the teachers to augment specific Sensory Path interventions that the teachers could implement into their classrooms.

Capstone fieldnotes captured teachers expressing feelings that this was easier to implement than they thought, they were surprised about how well the classes were able to complete the activity, as well as seeing the benefits of the Sensory Paths during their circle times. This supports the literature that teachers recognize the benefits of collaborating with occupational therapists, that they are willing to implement group interventions that they feel they have been well trained in and that do not take up too much time (Mills, & Chapparo, 2017; Wilson & Harris, 2017). As reported in fieldnotes during the second week of Phase B1, the teacher expressed opinions that the children "had a good day" or "were able to pay attention to the lesson". This anecdotal information supports the connection between out of seat events and attention and learning.

This project is supported by the scientific underpinnings of EHP. In this project the occupational therapists collaborated with the teacher and the children to look at all aspects of the circle time activity. This collaboration supported the occupational therapist in providing client centered, occupation-based interventions in the most natural environment, (Clark, 1993) in the playground and used before circle time, to mediate an identified challenging activity. The ability of the Sensory Paths to evoke change in out of seat events relates to the concept that children are open beings (Dunn et al., 1994). EHP relies on the inter-relationship that occurs between the person, the task and the context and that making a change in any one of these components will influence the others. Therefore, the addition of the Sensory Path project, created a change to the environment had a positive outcome on task performance and impacted the teachers to effectively shape the lives of the children of today (Clark, 1993; Wilcock, 1993; Wilcock, 2005).

EHP theory considers a variety of interventions for the occupational therapist to augment a plan that is customizable to the specific needs of the child and/or the class. This capstone project studied out of seat events during circle time; however, circle time may not be a challenge for all classes. Some classes may have challenges at lunch, or art. The application of the Sensory Path intervention can be customized to the needs of all classes.

Interventions supported by EHP include create and promote. Create is where the occupational therapist augments an opportunity where there was none (this is a new treatment intervention) and promote is the implementation of an intervention that is meant to prevent or slow the progress of a negative reaction (out of seat events). The Sensory Path intervention embraces both concepts. The Sensory Paths created an opportunity where there once was none, for children to be able to engage in playground types of movements that can help to build neural pathways in their brains. The children enjoyed participating in the sensory path activities even without adult intervention. This is important because if this sensory path opportunity was not created these children would never have known the opportunity. The second EHP intervention concept supported by this capstone project is promote. The timing of the Sensory Path intervention is crucial for successful outcomes. The Sensory Paths were being used prior to a challenging activity, circle time, to promote a child's ability to prepare themselves to be able to sit during circle time.

However, impressions recorded through observations in fieldnotes were that the Sensory Paths did have benefits in alleviating out of seat events in this sample population. In addition to a decrease in events, there was a shift in the quality of the events. For example, the out of seat events appeared to be less intense, and if they did occur, it appeared as though the child was able to resume a seated position with less adult intervention. For example, after the intervention, a child may only need a verbal cue to sit rather than physical redirection. This supports the literature that suggests that there is a relationship between the ability to pay attention/learn/academic achievement and sensory movement-based activities (Lown, 2002, Zaghlawan & Ostrosky, 2010; Cherry, 2019; Geertsen et al., 2016).

Limitations

There are several limitations to this study that should be considered. The first limitation relates to the participants as this research study used a convenience sample. Due to this, caution should be used when applying the results to a larger or heterogenous population. Other limitations in this study were the ability to control the application of the Sensory Paths during free play, the small sample size, the extraneous variables, that the Sensory Paths were placed outside, as well as deviations in circle time structure, environment, content, number of children in each class, quarantining, and challenges that this research study encountered due to changing schedules of the data collection phase in the school calendar and most of these extraneous variables are part of a typical day in a preschool.

In addition, this study did not take into consideration the duration of the out of seat events and how that may impact the overall total of out of seat events. For example, a child may have remained out of their seat for 5 minutes per event but only 3 events were tracked on that day.

Implications for OT practice

This capstone project attempted to provide evidence for the use of the Sensory Paths, an easy to implement group intervention, which is occupational therapist driven and teacher completed to decrease out of seat events and increase attention in preschool children ages 3-5 during circle time. This is the first known project to look at the effectiveness of Sensory Paths; therefore, regardless of the outcomes, this capstone project fills a gap in the literature and justifies the need for future studies. Adding to the literature base improves a practitioner's ability to use evidence to support this sensory motor-based treatment intervention. When treatment interventions are supported by research it improves sustainability by providing occupational therapists with the evidence necessary to gain reimbursement from major funding sources such as insurance companies, school districts, Department of Health and Medicaid. Additionally, evidence-based interventions validate the unique contributions that occupational therapy has to offer, as a key research player amongst neurologists, exercise physiologists and other practitioners. The ability for occupational therapists to tap into the research of other professionals and apply it as an occupation-based intervention widens our own evidence base, as well as improves collaboration with other professionals. This project attempted to provide a comprehensive solution to a multifaceted problem by integrating different evidence-based ideas from the fields of occupational therapy, psychology, exercise physiology and neurology.

Future research

This capstone project lends itself to 2 main trajectories for future research. The first avenue is to enhance the validity, reliability and robustness of this study by repeating the research project with a larger sample of children, with varying ages, in non-homogeneous groupings. This study was completed over 4 weeks but a longer timeframe, such as 6 months, would strengthen the study. Adding measures to account for duration and intensity of out of seat events may yield more detailed information that can be used to structure and implement Sensory Path interventions. Additionally, more information could be extrapolated by repeating this study and adding measures to include a child's ability to learn and using a mixed methods design, where the perspectives of the teachers and even the students were collected. Lastly, investigating the possible effects of Sensory Paths by broadening the scope of the intervention to other diagnosis or challenges and learning that children may have.

The second trajectory would be to complete research that specifically investigates the functioning of the brains of the participants while they are engaging in the Sensory Path intervention. By linking principles of exercise physiology, psychology, and neurology with sensory integration principles, a comprehensive interprofessional intervention can be created. The tenets of the Sensory Path interventions are rooted in Sensory Integration theory, neurology and exercise science. A continued investigation of these factors can help to link them together and highlight their unique contribution to Sensory Paths.

Conclusion

Based on the evidence provided in this capstone project, the Sensory Paths were effective in reducing the number of out of seat events in children with special needs, as well as reducing the intensity of the events. The children enjoyed participating in the sensory path activity, so much so, that they began to independently participate in them without adult direction. The creation of this activity, where there once was none, will continue to enhance the recess play of the children in schools. The teachers found the sensory paths easy to implement and the use of the Sensory Paths yielded positive outcomes for the children in their classes as evidenced by a decrease of frequency and intensity of out of seat events. Additionally, the teachers felt that the collaboration with the occupational therapist was beneficial. This results of this capstone project are inconclusive but they do suggest that the Sensory Paths are an effective intervention to decrease out of seat events for preschool children with special needs during circle time. Occupational therapists and occupational therapy assistants should use this information to support their clinical decisions in training and collaborating with teachers and classroom staff regarding the implementation of the Sensory Paths in the natural environment for the specific classroom challenges of both circle time and beyond.

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Appendices

Appendix A

Parent/Guardian Permission for a Child to Participate in a Research Study

Get the Wiggles Out: Sensory Paths a motor-based intervention to decrease out of seat events in preschool children with special needs.

EKU

Institutional Review Board
Protocol Number
3708

Approval Valid
12/24/20-12/5/21

Key Information

Your child is being invited to participate in a research study. This document includes important information you should know about the study. Before providing permission for your child to participate, please read this entire document and ask any questions you have.

Does my child have to participate?
If you decide to permit your child to take part in the study, it should be because you really want to allow him or her to volunteer. Your permission allows us to ask your child to participate, but he or she does not have to participate, even if you grant permission. Your child will not lose any benefits or rights he or she would normally have if you choose not to grant permission or if your child chooses not to participate. Your child can stop at any time during the study and still keep the benefits and rights he or she had before volunteering. If you decide to grant permission for your child's participation and your child chooses to participate, he or she will be one of about 20-40 people in the study.

What is the purpose of the study?

The purpose of the study is to investigate the efficacy of Sensory Paths a motor-based intervention to decrease out of seat events in preschool children with special needs. Terrie Ludwig, MS OTR/L, the occupational therapy coordinator at Variety Child Learning Center, will be spearheading this project as part of her Occupational Therapy Doctoral program at Eastern Kentucky University. Your child has been chosen because they are enrolled at Variety Child Learning Center. By doing this study, we hope to gain an understanding of the effects that movement based interventions, such as Sensory Paths, will have on out of seat events in preschool children ages 3-5, who are enrolled in special needs preschool during a 20-30 minute circle time.

Where is the study going to take place and how long will it last?
The research procedures will be conducted at Variety Child Learning Center, Syosset Campus. Your child will need to come to school on their regular times during the study. The study will take place during the classroom day. Your child will be asked to engage in the Sensory Paths (that are part of the outdoor playground) for 10-20 minutes a day for 10 school days. The total amount of time your child will be asked to volunteer for this study is for 15 school days (5 days of observation during the classroom's scheduled circle time followed by 10 days of engagement in the Sensory Paths prior to classroom's scheduled circle time, then observation during the classroom' scheduled circle time).

What will my child be asked to do?

Upon joining this study, your child will be observed during circle time, Terrie Ludwig, and the number of out of seat events that your child displays will be tracked. This will occur for one week (5 school days). After the first week, you child, as part of the class, will participate in the Sensory Path intervention. Sensory paths are "colorful, creative and playful ways pathways that are painted on the playground of the Syosset campus. The children will be asked to run, jump, skip and bear crawl along the paths for 10-20 minutes. Following engagement in the Sensory Path activity, your child will return to his/her class for circle time. Your child will be observed by Terrie Ludwig, and the number of out of seat events that your child displays will be tracked. This will occur for two weeks (10 school days). The total commitment from your child is 3 weeks.

Are there reasons why my child should not take part in this study?
All English-speaking children who are enrolled at Variety Child Learning Center are eligible to participate in this study.

What are the possible risks and discomforts?
As with any research study there are risks involved. However, the risk is minimal. The children are being asked to participate in movements that are part of typical playground play and the Sensory Paths are available to the children during general recess. If any problems emerge, the researchers will do their best to rectify the problem in a timely manner. There is a nurse on site.

Your child may, however, experience a previously unknown risk or side effect.

What are the benefits of taking part in this study?
There is no guarantee that your child will get any benefit from taking part in this study. However, some people have experienced decreased out of seat events after participation in the Sensory Paths. We cannot and do not guarantee that your child will receive any benefits from this study. Your child's participation is expected to provide benefits to others by adding a possible intervention that can be used by all the classroom to improve in seat events during the.

If my child doesn't take part in this study, are there other choices?
If your child does not participate in this study, there are other choices, including use of the Sensory Paths, with his/her class, as part of the classroom day.

Now that you have some key information about the study, please continue reading if you are interested in allowing your child to participate. Other important details about the study are provided below.

Other Important Details

Who is doing the study?
The person in charge of this study is Terrie Ludwig, MS OTR/L at Eastern Kentucky University. She is being guided in this research by Camille Skubik-Peplaski PhD, OTR/L FAOTA. There may be other people on the research team assisting at different times during the study.

What will it cost for my child to participate?
There are no costs associated with taking part in this study.

Will my child receive any payment or reward for taking part in the study?
Your child will not receive any payment or reward for taking part in this study.

Who will see the information my child gives?
Your child's information will be combined with information from other people taking part in the study. When we write up the study to share it with other researchers, we will write about this combined information. Your child will not be identified in these written materials.

We will make every effort to prevent anyone who is not on the research team from knowing that your child gave us information, or what that information is. For example, your and your child's names will be kept separate from the information your child gives, and these two things will be stored in different places under lock and key.

However, there are some circumstances in which we may have to show your child's information to other people. For example, the law may require us to show your information to a court. Also, we may be required to show information that identifies your child for audit purposes.

Can my child's taking part in the study end early?
If your child decides to take part in the study with your permission, he or she will still have the right to decide at any time that he or she no longer wants to participate. Your child will not be treated differently if he or she decides to stop taking part in the study.

The individuals conducting the study may need to end your child's participation in the study. They may do this if your child is not able to follow the directions given, if they find that your child's being in the study is more of a risk than benefit to him or her, or if the University or agency funding the study decides to stop the study early for a variety of scientific reasons.

What happens if my child gets hurt or sick during the study?
If you believe your child gets hurt or sick because of something that is done during the study, you should call Terrie Ludwig at 516 921-7171 ext. 2192 immediately. It is important for you to understand that Eastern Kentucky University will not pay for the cost of any care or treatment that might be necessary because your child gets hurt or sick while taking part in this study. Also, Eastern Kentucky University will not pay for any wages you may lose if your child is harmed by this study. These costs will be your responsibility.

Usually, medical costs that result from research-related harm cannot be included as regular medical costs. Therefore, the costs related to your child's care and treatment because of something that is done during the study will be your responsibility. You should ask your insurer if you have any questions about your insurer's willingness to pay under these circumstances.

What if I have questions?
Before you decide whether to accept this invitation to grant permission for your child to take part in the study, please ask any questions that come to mind now. Later, if you have questions about the study, you can contact the investigator, Terrie Ludwig at 516-921-7171 ext. 2192; thoppe@vclc.org. If you have any questions about your rights or your child's rights as a research volunteer, you can contact the staff in the Division of Sponsored Programs at Eastern Kentucky University at 859-622-3636.

What else do I need to know?
This study is being completed in conjunction with Variety Child Learning Center. You will be told if any new information is learned which may affect your child's condition or influence your willingness to allow your child to continue taking part in this study.

We will give you a copy of this permission form to take with you.

Permission

Before you decide whether to accept this invitation to give permission for your child to take part in the study, please ask any questions that come to mind now. Later, if you have questions about the study, you can contact the investigator, Terrie Ludwig at 516-921-7171, ext. 2192; thoppe@cvlc.org. If you have any questions about your child's rights as a research volunteer, you can contact the staff in the Division of Sponsored Programs at Eastern Kentucky University at 859-622-3636.

If you would like to give permission for your child to participate, please read the statement below, write your name and your child's name, and sign.

I have thoroughly read this document, understand its contents, have been given an opportunity to have my questions answered, and give permission for my child to participate in this study if he/she chooses to participate.

Parent/Guardian's Name	Date	Child's Name	Date
Parent/Guardian's Signature	Date	Witness Signature	Date

Appendix B

Daily Tracking Sheet

Class Number

Date

Child ID	Child A	Child B	Child C	Child D	Child E	Child F	Child G	Child H
1								
2								
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33								

34								
35								
36								
37								
38								
39								
40								
Total events								

Appendix C

Weekly Summary Sheet

Week

Child ID	Day 1	Day2	Day 3	Day 4	Day 5	Total	Average #	Average
Child A								
Child B								
Child C								

Appendix D

GET THE WIGGLES OUT: SENSORY PATHS

A MOTOR BASED INTERVENTION TO DECREASE OUT OF SEAT EVENTS IN PRESCHOOL CHILDREN

Variety Child Learning Center, in conjunction with Eastern Kentucky University OTD student, and Terrie Ludwig, are inviting your child to participate in a research project designed to gain an understanding of movement based interventions, such as the Sensory Paths, and their effect on out of seat behavior during circle time.

Sensory paths are colorful, creative and playful ways pathways that are painted on the playground of the Syosset campus. The children will be asked to run, jump, skip and bear crawl along the paths.

This project hopes to provide evidenced based interventions for all the classroom to use to improve in seat events during the school day.

--I am interested in participating in the Capstone Project Child's Name_________________________________

DATES

August – September 2021

If interested please return the bottom portion of the flyer in your child's backpack or contact Terrie Ludwig at Thoppe@vclc.org

516-921-7171 ext. 2192

Appendix E

Dear Parent,

Your child’s class has been invited to participate in the Capstone Project entitled, Get the wiggles out: Sensory Paths a motor-based intervention to decrease out of seat events in preschool children with special needs. Terrie Ludwig, MS OTR/L, the occupational therapy coordinator at Variety Child Learning Center, will be spearheading this project as part of her Occupational Therapy Doctoral program at Eastern Kentucky University.

The purpose of this Capstone Project is to gain an understanding of the effects that sensory based movement interventions, such as Sensory Paths, will have on out of seat events in preschool children ages 3-5, who are enrolled in special needs preschool during a 20-30-minute circle time?

Upon joining this study, your child will be observed during circle time, Terrie Ludwig, and the number of out of seat events that your child displays will be tracked. This will occur for one week (5 school days). After the first week, you child, as part of the class, will participate in the Sensory Path intervention. Sensory paths are “colorful, creative and playful ways pathways that are painted on the playground of the Syosset campus. The children will be asked to run, jump, skip and bear crawl along the paths for 10-20 minutes. Following engagement in the Sensory Path activity, your child will return to his/her class for circle time. Your child will be observed by Terrie Ludwig, and the number of out of seat events that your child displays will be tracked. This will occur for two weeks (10 school days). The total commitment from your child is 3 weeks.

As with any research study there are risks involved. However, the risk is minimal. The children are being asked to participate in movements that are part of typical playground play and the Sensory Paths are available to the children during general recess. If any problems emerge, the researchers will do their best to rectify the problem in a timely manner.

Data collected from this study to gain an understanding of the effects that sensory based movement interventions, such as Sensory Paths, will have on out of seat events in preschool children ages 3-5, who are enrolled in special needs preschool during a 20-30-minute circle time?

The privacy of subject’s personal information will be protected by abiding to all Health

Insurance Portability and Accountability Act (HIPAA) regulations. Names and other personal identifying information will not be included in the resulting data and all data will be deidentified.

Participation in this study is fully voluntary. If you decide not to participate in this study,

the quality of care, relationships and services will not be affected, and your child will still have access to the Sensory Path activities. If you decided that you no longer wish to participate in this study, you may do so at any time without penalty. There is no cost for participating in this study nor is their compensation.

Thank you for your consideration,

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