

EFFECTIVENESS OF A DYNAMIC SEATING DEVICE, DISC 'O' SIT, ON  
ATTENTION TO TASK IN THIRD GRADE STUDENTS  
WITH ATTENTION DIFFICULTIES

A THESIS

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BY

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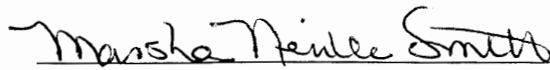

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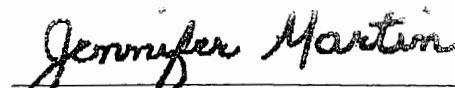
I am submitting herewith a thesis written by Leanne M. Johnson entitled "Effectiveness of a Dynamic Seating Device, Disc 'O' Sit, On Attention to Task in Third Grade Students with Attention Difficulties." I have examined this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts with a major in Occupational Therapy.

  
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We have read this thesis and recommend its acceptance:

  
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## ABSTRACT

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### EFFECTIVENESS OF A DYNAMIC SEATING DEVICE, DISC 'O' SIT, ON ATTENTION TO TASK IN THIRD GRADE STUDENTS WITH ATTENTION DIFFICULTIES

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The purpose of this study was to investigate the effectiveness of using Disc 'O' Sits, on improving third grade students' on-task behaviors while engaged in a language arts task. A single subject, A-B-A-B design was utilized which included three third-grade students ranging in age from 8 to 10 years. All three participants were male and had a documented history of attention difficulties within the classroom. During baseline and withdrawal phases, participants sat on their classroom chairs, while during the intervention phases, they sat on Disc 'O' Sit cushions. The target students were observed for in-seat behavior and engagement. Data were graphed and visually analyzed for differences between study phases. Results were varied for each student. Marked improvement in in-seat behavior was noted in one student, while another student demonstrated possible improvements in engagement. A third student did not show improvements in either in-seat behavior or engagement.

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## CHAPTER I

### INTRODUCTION

Nearly 10% of children in the U.S. are diagnosed with Attention Deficit Hyperactivity Disorder (Centers for Disease Control and Prevention, 2003); therefore, it is likely that every teacher deals with students with either diagnosed or undiagnosed attention difficulties within their classroom. Researchers are no longer looking at attention disorders as simply behavior problems. Specialists are recognizing the disorders as complex syndromes which affect a person's executive functioning in areas such as organizing & initiating tasks, attending, avoiding distractions, regulating arousal or alertness levels and shifting focus as needed (Brown, T.E., 2007). Sensory modulation or sensory processing disorders are also believed by some to affect children's ability to attend. Researchers report that children with attention disorders often present with sensory processing or modulation disorders and that there are behavioral similarities between the two disorders (Vandenberg, 2001; Mangeot, 2001). Occupational therapists within the school based setting have used a number of sensory strategies over the years in an effort to assist children with attention disorders, such as dynamic seating devices. Studies on the use of one dynamic seating device, the therapy ball, have tended to focus on posture and back health and have therefore only provided anecdotal evidence regarding the effect on attention (Schilling, 2004). Other studies have looked into the use of other dynamic seating devices, however, small sample sizes, limitations in research

designs and the use on non-standardized outcome measures have allowed for only limited generalization of the findings. This research project further explored the impact of the use of the Disc 'O' Sit, a dynamic seating device, on the attention to task behaviors of elementary school students.



CHAPTER II  
REVIEW OF LITERATURE  
Attention and ADHD

Attention is described as a process in which one must consciously focus on relevant stimuli and simultaneously block out, or ignore, irrelevant stimuli (Pfeiffer, Henry, Miller, & Witherell, 2008). Children are required to engage in this process continuously throughout a typical school day. Attention is the primary issue in the most frequently diagnosed neurobehavioral disorder in children, Attention Deficit Hyperactivity Disorder (ADHD). Current estimates of the prevalence of ADHD range between 5-10% (Mulligan, 2001) to 8%-12% worldwide (Adams, Finn, Moes, Flannery & Rizzo, 2008). According to the Centers for Disease Control (2003), 7.8% of children in the United States between the ages of 4-17 are diagnosed with ADHD by their parent(s). Given these statistics, it is likely that most teachers will have at least one to two students diagnosed with an attention disorder in their classrooms each year, in addition to other students with undiagnosed attention difficulties.

Researchers no longer consider attention disorders as simply behavioral problems. VandenBerg (2001) describes attention difficulties as patterns of inattention and/or hyperactivity which are persistent, frequent and more severe than normally found in children at a similar level of development. According to the *Diagnostic and Statistical Manual of Mental Disorders IV*, the three key features of ADHD include inattention,

impulsivity and hyperactivity which affect academic and/or social skills across more than one setting. Specialists are recognizing attention disorders as complex syndromes which affect a person's executive functioning in areas such as organizing and initiating tasks, attending, avoiding distractions, regulating arousal or alertness levels and shifting focus as needed (Brown, 2007). The ability of a child to accurately sustain attention and regulate his or her level of arousal becomes more important as he or she enters school and the demands of the classroom increase from year to year. Behaviors observed in ADHD often present themselves within the school setting during the early school years (Meaux, 2000), placing children with ADHD at risk academically and socially.

Children with attention disorders cannot always function independently within the general education setting without accommodations or special education support (VandenBerg, 2001). Both the Individuals with Disabilities Education Improvement Act of 2004 and Section 504 of the Rehabilitation Act of 1973 require schools to provide accommodations for children with ADHD in the general and special education environments. Occupational therapists working within the school-based setting are sometimes called upon to work with students with ADHD and assist teachers in providing accommodations to children with attention difficulties (Leslie, Lambros, Aarons, Haine & Hough, 2008).

### *Sensory Integration and Sensory Modulation Disorders*

Sensory integration is described by Ayres (1979) as the neurological process that organizes sensations from both within a person's body and from his or her environment in order to use one's body effectively. It is the ability to interpret, process, and make

necessary adjustments to the many types of incoming sensory information that we receive through our senses. All of the senses work together to interpret and make the necessary adjustments required to register, react to, or even ignore the flood of sensory information that is constant throughout the day. If disruptions take place within this sensory network or there is faulty processing of sensory information, then behaviors which could negatively impact a child's ability to attend may occur, and he or she may have difficulty performing necessary daily tasks.

The brain is able to modulate or regulate and organize sensory information through the process of either facilitation or inhibition. In other words, through the process of sensory modulation, the brain is able to decide whether to pay attention to or to ignore incoming sensory information (Pfeiffer et al., 2008). According to Lane, Miller, and Hanft (2000), sensory modulation disorders affect a child's ability to achieve and maintain a proper level of arousal or alertness needed for performance. Children with sensory modulation disorders typically present with one of two patterns of behavior or fluctuate between the two patterns. Children with high thresholds or tolerance to sensory stimuli within their own body or environment tend to seek out more or stronger stimulation in order to compensate for their high tolerance. In the second pattern, children demonstrate low thresholds or tolerance to sensory stimuli and are, therefore, hypersensitive to stimulation and tend to avoid exposure to the stimuli which they are not able to easily tolerate. Regardless of which type of response a child demonstrates, difficulties with modulating sensory information may make it difficult for the child to self-regulate his or her alertness level. A breakdown in this process of modulating

sensory information has been associated with emotional and attentional difficulties (Mangeot et al., 2001).

Researchers report that children with attention disorders often present with sensory processing or modulation disorders (VandenBerg, 2001; Mangeot et al., 2001). Children may be easily distracted by stimuli within their environment that others are able to ignore or may frequently shift from one task to another. Difficulty remaining seated, difficulty initiating and completing tasks, making noises, grabbing and touching objects, and general impulsivity are behavioral characteristics of both ADHD and sensory processing and modulation disorders. Both disorders are also characterized by difficulty with achieving and maintaining proper levels of arousal or alertness needed for learning. Miranda, Presentacion & Soriano (2002) state that studies conducted over the past 10 years support the hypothesis that children with ADHD demonstrate impairments in self-regulation. Teicher, Ito, Glod & Barber (1996) report that studies utilizing portable electronic activity monitors have shown that children with ADHD are approximately 25% to 35% more active than non-ADHD children during academic activities.

#### *Treatment Strategies for ADHD*

Over the years, a vast number of treatment strategies have been utilized in an attempt to reduce the symptoms of ADHD. The use of stimulant drugs began with Dr. Charles Bradley in the late 1930's when he accidentally discovered that children responded to the stimulants with improved behaviors and concentration. Use of stimulant medications increased rapidly into the 1970's until concerns about "drugging" children began, despite continued scientific support for the use of stimulants (Meaux, 2000).

Miranda et al (2002) reports the use of psychostimulant medications as the current “treatment of choice” for ADHD. Psychostimulant medications are believed to improve behavioral inhibition as well as executive functions. In the treatment of ADHD, these medications are found to improve attentiveness and decrease impulsivity resulting in improved learning and social skills while decreasing impulsivity. Academic abilities, however, have not been shown to improve to the same level with the use of psychostimulant medications. Despite behavioral improvements with medication, some children do not demonstrate cognitive benefits and long-term positive changes have not been substantiated.

Brown (2007) discussed the use of medications in the treatment of attention disorders in relation to their ability to compensate for an insufficient release of dopamine and norepinephrine. Evidence has shown that children with attention difficulties have impairments that are related to the release of these two neurotransmitters in the brain. Although Brown reported that 8 out of 10 people treated with medications for attention disorders experience improvements, he also reports that the use of medications does not cure attention disorders. Medications will alleviate symptoms only for a limited time frame while the medication is active in the brain. For some, this is sufficient to allow improved functioning; while for others, additional strategies are necessary. These limitations of medication treatments emphasize the need for other types of treatment programs to augment their use.

A number of non-medication treatment approaches are used in the treatment of children with ADHD. A common treatment approach utilized by teachers is behavioral

therapy. In this approach, strategies are used to control disruptive behaviors while teaching children to use appropriate behaviors more effectively. A variety of approaches fall into the category of behavioral therapy including using positive or negative reinforcement, token economies, time-out, verbal reprimands, individualized behavior programs and behavior self-management programs (Mulligan, 2001). Goldman, Genel, Bezman & Slanetz (1998) report that behavioral interventions alone have not been proven to be effective. However, when combined with medication, they can be an effective treatment regimen for ADHD. In 2005, Brown et al. conducted an extensive review of the evidence in the treatment for ADHD. They found that the evidence shows medication management and a treatment approach that combines treatment strategies are more effective than behavioral therapy alone.

Several treatment strategies for ADHD are often used in a multi-modal approach. Multi-modal approaches commonly combine pharmacotherapy with strategies such as environmental modifications, curriculum modifications, parent education and training, social skills training or support groups (Mulligan, 2001; Goldman et al., 1998). Environmental modifications within the classroom are used to reduce distractions. Children can be placed at the front of the room or close to the teacher's desk to allow them to more easily focus which also places the student and teacher closer to one another to allow closer monitoring. Students with attention disorders can be paired with a peer role model. Placing a student away from the window or away from hallway noise, reducing the amount of visual distractions or utilizing quiet areas or study carrels are additional ways in which the environment can be modified to assist children with

focusing. The student's curriculum can be modified in order to help students struggling with attention difficulties. The content of the curriculum can be modified or the way in which the curriculum is delivered to the student can be adapted to best serve the student's learning style (Mulligan, 2001). Parent training programs may focus on teaching parents behavior management techniques in order to decrease disruptive behaviors within the home while increasing parents' self-confidence level in dealing with their child's attention difficulties. Teaching children social skills and providing children and their families access to support groups are also frequently utilized in multi-modal treatment programs. Goldman et al.'s 1998 review, noted that multi-modal treatment demonstrated long-term results in a few studies; however, the applicability of these findings remained unclear in his review.

As previously stated, children with attention disorders also often present with sensory processing or modulation disorders. Because of this connection between the two disorders, a number of sensory processing or modulation strategies are used to assist children in attending to tasks by allowing them to achieve and maintain optimal arousal levels (Schilling & Schwartz, 2004). Sensory strategies help children who have difficulty achieving and maintaining appropriate arousal levels by providing their nervous systems with the type and amount of stimulation that their bodies need. For children who are underresponsive to sensory stimuli, sensory strategies aim at increasing their level of arousal through activities such as sucking on sour candy, chewing gum, increasing proprioceptive and vestibular stimulation through movement or using special seating which allows for in-seat movement. Strategies are also used for children who are

overresponsive to sensory stimuli. These strategies are used to decrease children's arousal level through calming activities such as using hand fidgets, dimming the lights, providing deep pressure input through the use of weighted vests or lap pillows or allowing children outlets for their excess motor activity (Mulligan, 2001).

### *Dynamic Seating Strategies for Attention*

Lange (2000) refers to the term *dynamic seating* as a seating device which allows movement while seated. She hypothesized that sitting in one position for a period of time, such as in a standard classroom chair, decreases proprioceptive and kinesthetic stimulation to the body, which can lead to decreased attention due to underarousal. Nackley (2001) reported that children who have difficulty discriminating proprioceptive and vestibular input may demonstrate difficulties such as poor balance or posture, increased movement or fidgeting and poor attention. Studies have shown that students with ADHD demonstrate increased movement while seated compared to their typically developing peers (Teicher et al., 1996). It is theorized that this pattern of increased movement of children with attention disorders is their attempt to get more sensory input in order to self-regulate their level of arousal in order to attend. Treatments for these difficulties focus on providing opportunities for increased proprioceptive and vestibular stimulation. In turn, participation in these activities will allow for improved balance, posture and attention through self-regulation of arousal or alertness levels. The current literature demonstrates that this type of intervention is currently used within the school-based setting as a strategy to promote improved sensory modulation and attention (Pfeiffer et al., 2008).



Although the use of therapy balls in place of classroom chairs has been studied in relation to their effect on back health, these studies have provided anecdotal evidence in the effectiveness of improving attention as well. Witt and Talbott (1998) studied the use of therapy balls as chairs to see how posture was affected. They theorized that the use of therapy balls would allow for health movement of the spine while activating trunk musculature which is not allowed for with the use of standard classroom chairs. They also discovered that children showed increased attention, sustained sitting and improved work habits and behavior with the use of therapy balls versus chairs. They suggested that the increased movement of the spine and increased muscle activation may improve the children's sensory awareness through increased sensory stimulation. Schilling & Schwartz (2004) add that the use of the therapy balls may provide children with opportunities for active movement which in turn assists in maintenance of an optimal state of arousal. They also suggests that these behavioral observations of children while seated on the ball are compatible with Ayres' suggestion that an overexcited, or over responsive, child may be calmed by gentle rocking on the ball (Ayres, 1979). For an under responsive child, use of the therapy ball may help increase his or her arousal level to allow for improved attention. Although the studies focused on outcomes related to back health and posture, they provided anecdotal evidence of improvements in self-regulation of arousal levels and attention through the use of therapy balls as chairs.

Despite anecdotal reports of the positive effects of therapy balls on attention, no studies had researched the use of therapy balls as a seating option specifically for the purpose of improving attention or arousal levels prior to a study completed by Schilling,

Washington, Billingsley and Deitz in 2003. The purpose of the study was to investigate the use of therapy balls as a seating option for children with ADHD. The researchers sought to answer two questions: what effect does the use of therapy balls as chairs have on in-seat behavior and what effect does it have on legible word productivity? They also examined teachers' and students' opinions of the use of therapy balls as chairs to determine social validity.

Using a single subject, A-B-A-B interrupted time series design, Schilling et al. (2003) examined the effect of the use of therapy balls on in-seat behavior and legible word production with a convenience sample of three fourth-grade students with the diagnosis of ADHD. Findings from their study indicated that all three subjects demonstrated improvement in in-seat behavior with the use of therapy balls for seating. One student demonstrated no in-class sleeping behaviors while using the therapy ball as he had while using a chair. Another student, who demonstrated constant motion and frequent out-of-seat behavior in a chair, remained in her seat with less motion with the use of the therapy ball. The third student also demonstrated consistently improved in-seat behaviors while on the ball compared to his in-seat behavior in a classroom chair. In addition to improvement in in-seat behavior, all three participants legible work productivity was higher when seated on the therapy balls, supporting the researchers' hypothesis that improved in-seat behavior seated on balls versus chairs would also increase the amount of written work the students would produce.

Social validity examination revealed that all three participants preferred using the therapy balls over chairs for comfort, writing and productivity. In addition, 17 out of 21

of the other students in the class also reported preferring the use of therapy balls over chairs. When asked to comment on the use of the therapy balls, 26 of 30 responses were positive regarding the use of the therapy balls as chairs. Comments included increased freedom of movement, increased attention, improved handwriting, improved posture and the ability to keep his or her brain active and get work done better. The teacher's responses included positive support for the use of the therapy balls as well. The teacher felt that the students were more focused and remained calmer for approximately 30 to 45 minutes with the use of the therapy balls (Schilling et al, 2003).

In 2004, Schilling and Schwartz conducted a similar study using therapy balls as an alternative seating option for preschool children with Autism Spectrum Disorder (ASD). Although none of the participants were diagnosed with an attention disorder, difficulty with engagement, attention and appropriate in-seat behaviors are common amongst children with ASD and can interfere with a child's ability to fully participate within a classroom setting. A single subject, withdrawal design was used to investigate the effects of the use of therapy balls on engagement and in-seat behavior on four males with a physician diagnosis of ASD. All four participants were reported to have difficulties with in-seat behavior and engagement in tasks, although the specific concerns varied for each student. Social validity was again examined through the use of a teacher and teaching assistant questionnaire at the conclusion of the study.

Results from the study indicated that all four participants demonstrated improvement in classroom behaviors while using the therapy balls for seating followed by a decline in behaviors during the withdrawal phase. For three of the four participants,

an improvement in in-seat versus out-of-seat behavior was noted immediately. For the fourth student, whose out-of-seat behavior was not a concern, an improvement in his engagement and a decrease in oppositional behavior was observed. During the intervention phase of the study, all four participants' ability to engage appropriately in tasks increased substantially. Findings from the questionnaire given to staff following the study indicate that all responses strongly supported the use of therapy balls for seating. Staff reported increased student independence, improved completion of tasks, increased verbal thinking, attention and interaction with peers along with fewer avoidance behaviors (Schilling & Schwartz, 2004).

Findings from both of these studies on the use of therapy balls as a dynamic seating option for students who demonstrate difficulty with in-seat behavior, engagement and attention provide support for the use of therapy balls versus chairs. Both studies' interventions had an effect on the movement patterns the students demonstrated while seated on the ball. One explanation could be that the increased vestibular and proprioceptive stimulation provided for improved self-modulation and thus affected the students' ability to maintain optimal states of arousal. Researchers, however, can only hypothesize as to why the intervention was effective.

Schilling et al's 2003 study with children with ADHD demonstrated that this intervention was effective for three students who varied in gender, concomitant diagnosis and medication treatment. The authors suggest that this provides some support for generality of findings. The 2004 study completed by Schilling and Schwartz with four students with ASD provides empirically validated use of a sensory-based strategy. The

study's authors, however, caution not to over-generalize the finding and suggest that there is a need for more broad-based replication of the study to establish generality of the effects across a range of students with varying diagnoses which affect attention due to the use of small, non-randomized samples. Social validity of the use of therapy balls as seating alternatives to standard classroom chairs was supported in both the 2003 and 2004 studies as well. Both studies received feedback from teachers, teaching assistants and/or parents who reported positive behavioral changes with the use of therapy balls.

In 2008, Pfeiffer et al. conducted a similar study on the effects of dynamic seating on attention to task using Disc 'O' Sit cushions instead of therapy balls. This larger, randomized controlled trial design provided preliminary evidence of the effectiveness of another type of dynamic seating device. The authors of this study utilized a similar theoretical frame of reference to hypothesize that the use of the dynamic cushions would provide increased vestibular and proprioceptive stimulation which in turn would help children self-regulate their level of arousal for improved attention to task. The results indicated that the Disc 'O' Sit cushions did increase attention to task in second grade students as measured by the BRI section of the *Behavior Rating Inventory of Executive Function (BRIEF)*. Significantly lower scores on this subsection of the BRIEF indicated that this intervention supports appropriate self-regulation. These findings are consistent with the therapy ball studies in that the children who used the dynamic seating interventions were more focused and demonstrated improved attention to task when they were permitted to move within their seats.

While Pfeiffer et al.'s 2008 study utilized an experimental, pretest/posttest design with a larger sampling of students, the study did have limitations. One limitation was the use of an observational form used for inclusion criteria for the study which provided for subjective versus objective observation. The observational tool utilized was not a developed tool with established validity. It is possible that students who did not demonstrate attentional issues were included and those students who did demonstrate difficulties were excluded from participation resulting in the possibility of a heterogeneous sample. It is also possible that teacher bias may have been present and that teacher enthusiasm and teaching styles may have affected their willingness to participate.

Another limitation of Pfeiffer et al.'s study was the use of the *Behavioral Rating Inventory of Executive Function (BRIEF)*. While this tool is designed to determine a child's self-control and problem solving skills, which are aspects attention, the tool utilizes subjective teacher reporting (Pfeiffer et al, 2008). In this study, teachers completed the *BRIEF* prior to and following implementation of the Disc 'O' Sits for a two week period. Actual student behaviors were not directly observed and documented during the implementation phase. The results of this study indicated a significant difference in the percentage of change between the control and the treatment groups on subsections of the *BRIEF*; however, the effect size was small to medium indicating it is possible that other factors influenced the outcome. As with the therapy ball studies, the authors suggest further research into the use of Disc 'O' Sit cushions for increasing attention to task behaviors in students with attention difficulties.

## Statement of the Problem

Current legislation mandates that children with ADHD be provided with accommodations in order to be successful. This same legislation also requires the use of evidence-based practices in strategies used with all children. A small amount of research has shown the use of dynamic seating devices to be effective. Only one study in the use of Disc ‘O’ Sit cushions was found which reported an improvement in attention to task, through the use of subjective teacher reporting post-intervention only. Additional research into the use of dynamic seating devices, such as the Disc ‘O’ Sit, using direct observation of on-task vs. off-task behaviors is needed to seek evidence for their use with students with attention difficulties within the school-based setting.

## Purpose of the Study

The purpose of this study was to investigate the effectiveness of using a Disc ‘O’ Sit, a dynamic seating device, on improving third grade students with ADHD’s on-task behaviors while engaged in a language arts task in the classroom.

## Definitions and Terms

Attention: A process in which one must consciously focus on relevant stimuli and simultaneously block out, or ignore, irrelevant stimuli (Pfeiffer, Henry, Miller & Witherell, 2008).

Attention Deficit Hyperactivity Disorder (ADHD): A condition characterized by patterns of inattention and/or hyperactivity which are persistent, frequent and more severe than normally found in children at a similar level of development (VandenBerg, 2001). The three key features of ADHD include inattention,

impulsivity and hyperactivity which affect academic and/or social skills across more than one setting (*Diagnostic and Statistical Manual of Mental Disorders IV*, 1994).

**Sensory Integration:** The neurological process that organizes sensations from both within a person's body and from his or her environment in order to use one's body effectively. It is the ability to interpret, process, and make necessary adjustments to the many types of incoming sensory information that we receive through our senses (Ayres, 1979).

**Sensory Modulation Disorder:** Condition characterized by difficulty regulating and organizing sensory information through the process of either facilitation or inhibition affecting a child's ability to achieve and maintain a proper level of arousal or alertness needed for performance (Pfeiffer et al., 2008).

**On-task behavior:** Engagement in the processes to complete the activity as needed (VandenBerg, 2001).

**Dynamic Seating:** A seating device which allows movement while seated (Lange, 2000).

**Disc 'O' Sit:** A round, air-filled cushion designed to fit on a classroom chair to allow for movement while seated (Pfeiffer, 2008)

### Limitations and Assumptions

A limitation of this study was the short duration of the study (eight weeks) and a small sample size. Three third grade students with attention difficulties were utilized in this single subject design. Generalizations of the results to older or younger children, as well as generalization of findings beyond the experimental conditions were limited. The



only observer was the primary investigator; therefore, observer bias may have been present. However, the behavioral observation tool utilized was easy to use and objective in order to control for the possibility of observer bias. The teacher and observer were aware of which students received the intervention because the use of the Disc 'O' Sit cushions were visible. Therefore, the possibility of experimental bias may have existed. Finally, another limitation of the study was that interval sampling was used, therefore, the results of this study reflect periodic observations which do not measure actual duration of the observed behaviors.

## CHAPTER III

### METHODOLOGY

A single subject, A-B-A-B design was utilized in this study. The research design was based on the work of Portney and Watkins (2000) and Kennedy (2005) and provided two opportunities to evaluate the effects of the intervention during two separate intervention phases.

#### Participants

Three students with a physician diagnosis of ADHD or documented attention difficulties within the classroom setting were chosen to participate in this study. Attention difficulties within the classroom were confirmed through teacher report and a review of the students' files and/or Individualized Education Plans for documentation of the attention difficulties. The students were third graders attending a public school in rural Northern Michigan. Student chosen were currently working on grade level content and were either general education students or special education students receiving inclusion support. Students with known medical or physical conditions which affected his or her motor performance, as well as students who were reported to be regularly absent or pulled out of class during language arts were excluded from participation in this study.

#### Instruments

Disc 'O' Sit cushions, owned by the local intermediate school district's occupational therapy department, were utilized for this study. Disc 'O' Sit cushions are

inflatable, dynamic air-filled cushions placed on students' chairs to allow movement while seated. The cushions are available through a number of therapy supply companies such as PDP Products, Reability or Therapro and come in two sizes, the smaller of which is appropriate for the target population of this study.

A behavioral observation form was used to measure on-task and off-task behaviors of the target student (see Appendix A). On-task and off-task behaviors had been defined so that they could be physically characterized and counted. Data on two variables, in-seat behavior and engagement were collected as done in Schilling and Schwartz's 2004 study. In-seat behavior included sitting in a chair or on the Disc 'O' Sit cushion with any portion of the participant's buttocks in contact with the seat or cushion and the four legs of the chair in contact with the floor. Engagement with the task was further defined as when the student was following directions, oriented toward the appropriate activity, visually attending to the task, and either interacting with the materials or responding to or looking at the speaker. In group activities, engagement also included the student being oriented to and responding to peers in the activity. The student was required to be completing all engaged behaviors in order to be judged as engaged in the task. Off-task behavior was documented on the same two variables. When no portion of the student's buttocks was not in contact with the seat or cushion or less than four legs of the chair were in contact with the ground, the child was considered out of their seat and off-task. Non-engagement to the task at hand was documented when the student was not oriented toward the appropriate activity, not following directions, not visually attending, not interacting with the materials, not responding to or looking at the speaker

or was not oriented to or responding to peers during group activities. Observance of any one of the non-engaged behaviors resulted in the student being marked as non-engaged. The behavioral checklist was utilized for momentary-interval sampling in order to document the number of occurrences of on-task behaviors within five minute intervals throughout the 30 minute session (Kennedy, 2005).

### Procedure

IRB approval was received from Texas Woman's University as well as consent from the local school district, principal and classroom teacher prior to implementation of this study. A written consent letter from the school's principal as well as a parent consent forms authorizing their child's participation in the study were completed prior to the initiation of this study.

A single-subject, A-B-A-B design utilizing real-time or momentary-interval sampling was used to study comparisons between treatment (use of the Disc 'O' Sit cushions) and no treatment (use of standard classroom chairs without a dynamic seating device) conditions. The students were initially observed for baseline measures, then started with daily use of the Disc 'O' Sits, followed by withdrawal of the Disc 'O' Sits and finally the students were allowed to utilize the Disc 'O' Sits again. Each phase lasted two weeks, for a total of eight weeks. Twice a week, the target students were observed during regularly scheduled language arts activities. The target students were directly observed in five minute continuous intervals for a total of 30 minutes each session to measure target behaviors repeatedly across baseline and intervention phases. Following instruction from the teacher, interval sampling began and lasted for 30 minutes. At each

five minute interval, the students' work behaviors were recorded on the behavioral observation form, the most common approach for assessing behavioral acts (Portney & Watkins, 2000).

Phase one (A): In this phase, the therapist observed the target students at the same time each morning session sitting in their standard classroom chairs during their daily language arts writing assignments. The students were monitored for two sessions per week for two weeks to establish a baseline.

Phase two (B): In this phase, the therapist introduced the Disc 'O' Sit cushions to the class. The therapist demonstrated use of the cushions and guidelines, expectations and a schedule for the students to follow. The students used the Disc 'O' Sits following the schedule on a daily basis during their morning work. Observation of the target students took place twice a week for two weeks during their morning language arts writing tasks.

Phase three (A): In this phase withdrawal of the Disc 'O' Sits occurred. The target students were observed twice a week for two weeks during their morning language arts writing tasks sitting in their standard classroom chairs.

Phase four (B): In this phase, use of the Disc 'O' Sit cushions were reintroduced daily for two weeks to establish that there were behavioral changes using the cushions. The target students were again observed utilizing the Disc 'O' Sits during their morning language arts writing tasks twice a week during this phase.

All students within the classroom had access to Disc 'O' Sit cushions for a period of time during their morning work on a rotating basis determined by the teacher. The

target students were scheduled to use the Disc 'O' Sits during the observation period, however, they were not aware that they were individually being observed for this study.

### Data Analysis

Data was graphed and visually analyzed for differences during each observation session looking at the number out of six observations per 30 minutes the students were in-seat or engaged in the task. There were a total of four data points per variable per phase of the study for a total of 16 data points. Data from each five minute interval were plotted in a graphic display. The observations of on-task behaviors were plotted on the y axis and the observation session on the x axis. A visual analysis of the graphic display of data was utilized in the analysis of changes in on-task behaviors between study phases. Each of the three students has their own graph showing individual differences.

## CHAPTER IV

### RESULTS

#### In-Seat Behavior and Engagement: Student A

Data for Student A is shown in Appendix B. Graphic results for Student A are shown in figures 1 and 2 below. Student A was an eight year old male who received special education services under the eligibility of emotionally impaired. He was working on grade level content given inclusion support from the special education teacher, although was considered below academically proficient. He had a physician diagnosis of ADHD and a documented history of difficulty with attention to task within the classroom setting. His teacher reported that he had difficulty initiating and staying engaged in academic tasks. Student A's mother reported at his annual Individualized Education Planning meeting, that he had been on ADHD medication at the start of data collection, was taken off of the medication for a brief period of time and was then prescribed a different ADHD medication towards the end of data collection.

In the initial baseline session Student A was observed to be in his seat for six out of the six observation times. He was in his seat for five out of six, four out of six and six out of six observation times in the remaining baseline sessions. After introduction of the Disc 'O' Sit cushions, his in seat observations increased to six out of six for all four intervention sessions. Upon withdrawal of the Disc 'O' Sit cushions, Student A's in seat observations dropped to four out of six for two sessions, six out of six for one session and

five out of six for the last withdrawal session. When the Disc 'O' Sits were re-introduced Student A's in-seat observations fluctuated between five out of six for two and six out of six observations for two of the final four 30 minute observation sessions.

Over the 16 sessions, Student A was observed to be in his seat six out of six times for nine, or over half of the sessions. Six out of nine of the sessions were with the use of the Disc 'O' Sit cushion. He was observed to be in his seat less than six out of six times for seven of the sessions and five out of seven of these sessions were when he was not utilizing the Disc 'O' Sit cushion. In seat observations remained close to baseline and withdrawal levels with use of the Disc 'O' Sits, therefore, this data indicates no distinct change in level between the conditions for in-seat behavior for Student A.

Observations of engagement for Student A at the initial baseline phase were varied and fluctuated between five out of six times and one out of six observations of engagement. After introduction of the Disc 'O' Sit, Student A was observed to be engaged four out of six times for two sessions and then five out of six times for the remaining two intervention sessions. When the Disc 'O' Sit was withdrawn, observations of engagement for Student A again varied and fluctuated between five out of six, three out of six, two out of six and zero out of six observations of engagement. Following re-introduction of the Disc 'O' Sit cushion, Student A's observations of engagement increased from two out of six, to three out of six, four out of six and then five out of six for the final intervention observation session. Over the 16 sessions, Student A was engaged more than half of the observations for eight out of 16 sessions, six out of the eight of which were with the use of the Disc 'O' Sit. He was engaged for half or fewer of



the observations for eight out of 16 sessions, six out of eight of which were without the use of the Disc 'O' Sit. Engagement observations indicate there was an initial positive effect when the Disc 'O' Sit cushion was introduced, however, upon reintroduction of the cushion during the second intervention phase, Student A's levels remained close to baseline and withdrawal levels making it difficult to determine a clear positive pattern.

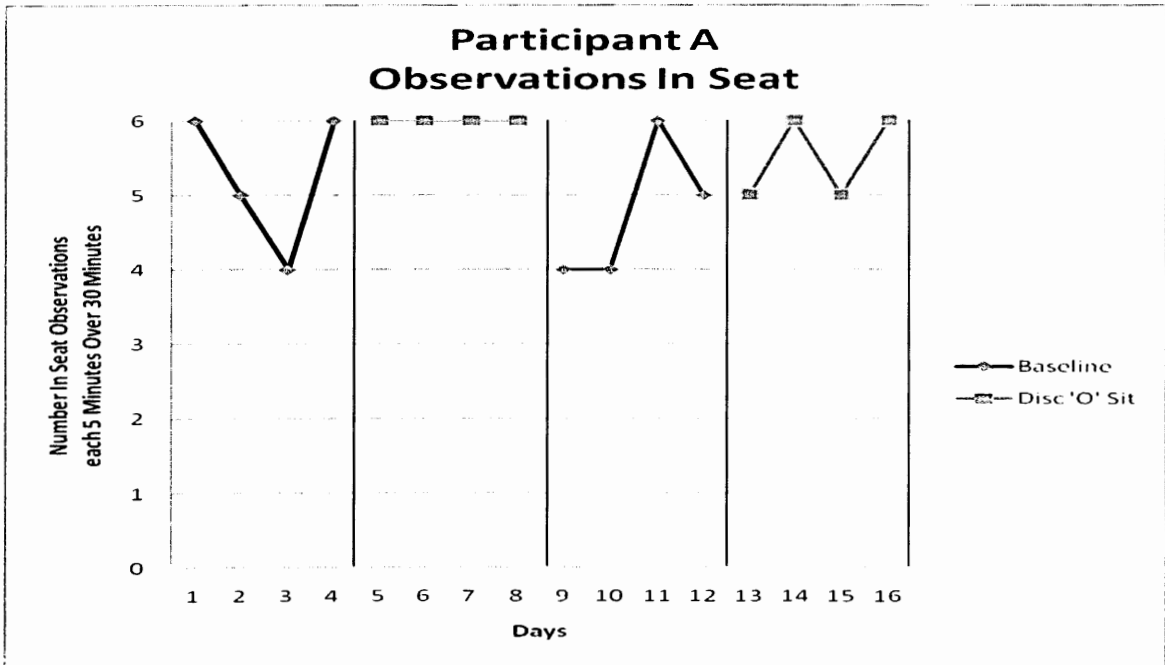


Figure 1. Number of in-seat observations each five minutes over 30 minutes during language arts activities by session.

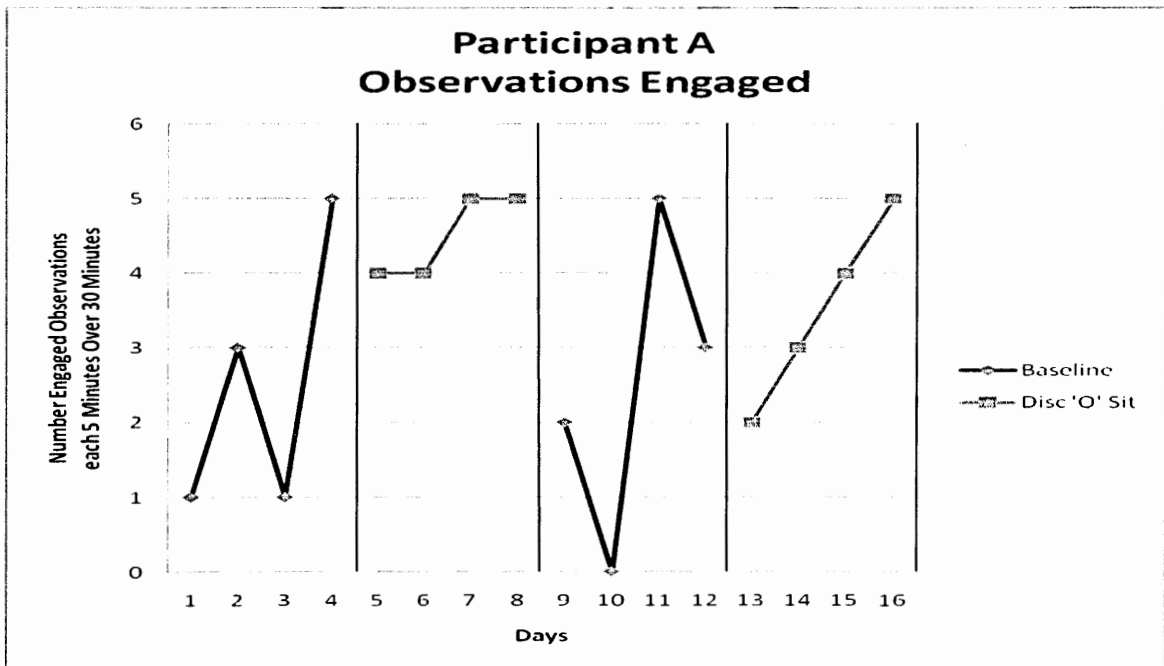


Figure 2. Number of engaged observations each five minutes over 30 minutes during language arts activities by session.

#### In-Seat Behavior and Engagement: Student B

Data for Student B are shown in Appendix C. Graphic results for Student B are shown in figures 3 and 4 below. Student B was a nine year old male currently working on grade level content within the general education setting. He had a history of difficulty with attention to task which was well documented in his school records during first, second and third grades. School records indicated a history of difficulty with organization, time management, completing assignments, independently initiating and completing tasks and following directions. His first grade teacher documented that he struggled to stay focused to complete his work. His second grade teacher documented that he had difficulty with independent work because he was easily distracted and moved about the room frequently which offered many opportunities for him to get sidetracked.

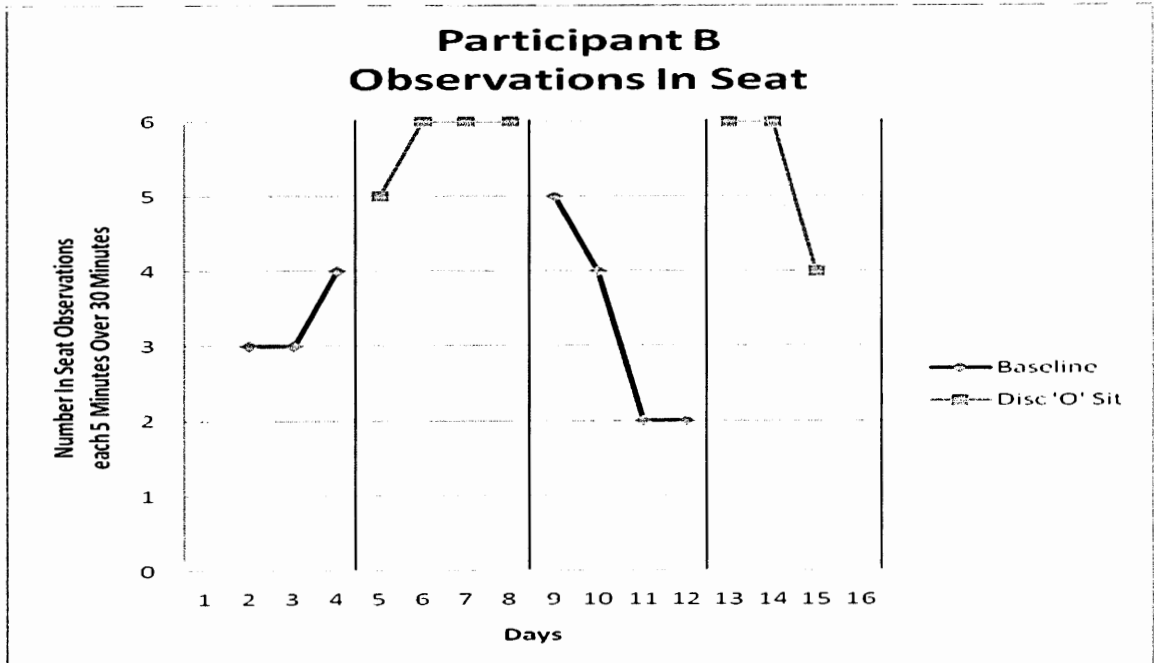
His third grade teacher reported that he continued to struggle in the above areas throughout this year and timeframe of this study. Student B's parents were not interested in considering medications to address his attention difficulties and therefore had not pursued a physician's diagnosis of ADHD despite his struggles with attention within the classroom setting.

Student B was absent from school for the initial baseline session. He was in his seat for three out of six, three out of six and four out of six observation times in the remaining baseline sessions. After introduction of the Disc 'O' Sit cushions, his in seat observations immediately increased to five out of six for one observation session and six out of six for the remaining three intervention sessions. Upon withdrawal of the Disc 'O' Sit cushions, Student B's in seat observations dropped back to five out of six for the first session, four out of six for one session and two out of six for the last withdrawal session. When the Disc 'O' Sits were re-introduced Student B's in-seat observations again immediately increased to six out of six for the next two sessions and four out of six for one session. He was absent from school for the last observation session.

Over the 16 sessions, Student B was observed to be in his seat five or six out of six times for seven, or half of the sessions for which he was observed. Six out of seven of the sessions were with the use of the Disc 'O' Sit cushion. He was observed to be in his seat less than five out of six times for seven of the sessions and six out of seven of these sessions were when he was not utilizing the Disc 'O' Sit cushion. This data indicates a distinct change in level between the conditions for in-seat behavior for Student B.

Observations of engagement for Student B at the initial baseline phase were varied and fluctuated between five out of six times and three out of six observations of engagement. After introduction of the Disc 'O' Sit, observations of engagement for Student B continued to be varied and fluctuated from five out of six, three out of six, two out of six and six out of six observations. When the Disc 'O' Sit was withdrawn, observations of engagement for Student A again varied and fluctuated between three out of six, one out of six, three out of six and four out of six observations of engagement. When the Disc 'O' Sit was re-introduced during the final phase of the study, Student B's observations of engagement continued to vary and fluctuate between three and five out of six.

Over the 16 sessions, Student B was engaged more than half of the observations for seven out of 14 sessions for which he was observed for. Of these seven sessions, four were with the use of the Disc 'O' Sit and three were without the use of the Disc 'O' Sit. He was engaged for half or fewer of the observations for seven out of 14 sessions, four out of seven of which were without the use of the Disc 'O' Sit. Engagement observations remained close to baseline and withdrawal levels when the Disc 'O' Sit cushion was utilized with this student indicating there were no distinct changes in levels between phases.



*Figure 3.* Number of in-seat observations each five minutes over 30 minutes during language arts activities by session. (Variability in the number of data points was the result of student absence from class.)

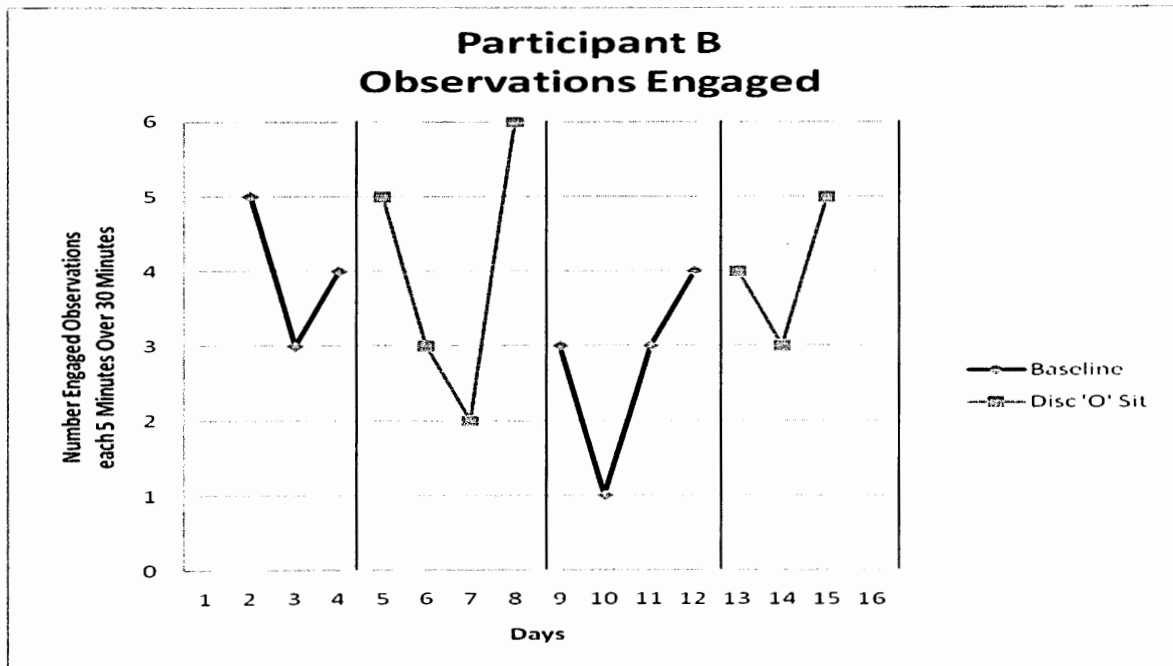


Figure 4. Number of engaged observations each five minutes over 30 minutes during language arts activities by session. (Variability in the number of data points was the result of student absence from class.)

#### In-Seat Behavior and Engagement: Student C

Data for Student C are shown in Appendix D. Graphic results for Student C are shown in figures 5 and 6 below. Student C was a 9 year old male who received special education services under the eligibility of specific learning disability. He was working on grade level content given inclusion support from the special education teacher. He had a physician diagnosis of ADHD and a documented history of difficulty with attention to task within the classroom setting. His teacher reported that he had difficulty initiating and staying engaged in academic tasks, although she also reported that since his diagnosis and placement on medication, he did not struggle with attention to task to the degree he had in the past.

In the initial baseline session Student C was observed to be in his seat for six out of the six observation times. He was in his seat for five out of six observations for the next baseline session and then six out of six observation times in the remaining two baseline sessions. After introduction of the Disc 'O' Sit cushions, his in seat observations remained between five out of six observations for one and six out of six observations two more observation sessions (he was absent for one of the four intervention sessions). Upon withdrawal of the Disc 'O' Sit cushions, Student C's in seat observations dropped to four out of six for two sessions, and five out of six for the last withdrawal session for which he was for during the withdrawal phase. When the Disc 'O' Sits were re-introduced Student C's in-seat observations increased to six out of six for two observation sessions and five out of six for one observations session. He was again absent one day during the final intervention phase.

Over the 16 sessions, Student A was observed to be in his seat six out of six times for seven, or over half of the 13 sessions for which he was present for observation. Four out of seven of the sessions were with the use of the Disc 'O' Sit cushion. He was observed to be in his seat less than six out of six times for six of the sessions and two out of six of these sessions were with the use of the Disc 'O' Sit while four out of six were when he was not utilizing the Disc 'O' Sit cushion. This data indicates no distinct change in level between the conditions for in-seat behavior for Student C.

Observations of engagement for Student C at the initial baseline phase were varied and fluctuated between five out of six times and one out of six observations of engagement. After introduction of the Disc 'O' Sit, Student C was observed to be

engaged four out of six, five out of six and six out of six times . When the Disc ‘O’ Sit was withdrawn, observations of engagement for Student C again varied fluctuated between four out of six for one observation and three out of six for the remaining two withdrawal sessions for which he was present for. Following re-introduction of the Disc ‘O’ Sit, Student C’s observations of engagement increased to between five to six out of six for the three intervention sessions for which he was present for.

Over the 16 sessions, Student C was engaged five to six out of six observations for seven, or just over half of the 13 sessions for which he was present for. Five of the seven sessions were with the use of the Disc ‘O’ Sit. He was engaged for four or fewer out of six of the observations for six out of 13 sessions, five out of the six of which were without the use of the Disc ‘O’ Sit. Engagement observations indicate there was a possible effect when the Disc ‘O’ Sit cushion was being utilized with Student C.



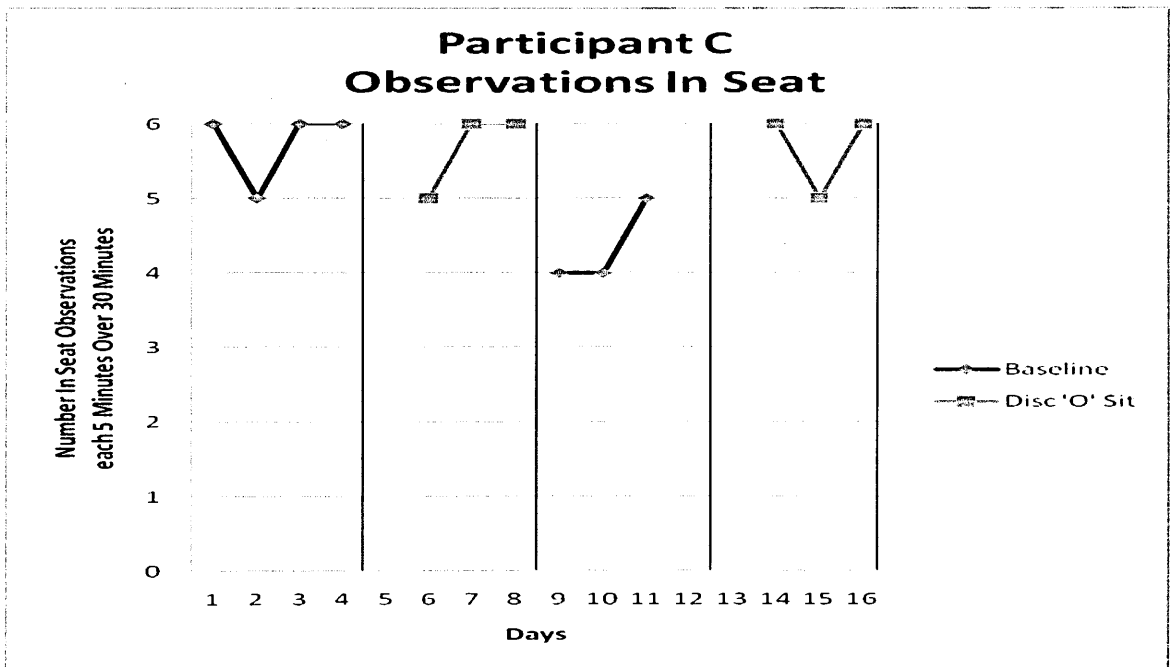


Figure 5. Number of in-seat observations each five minutes over 30 minutes during language arts activities by session. (Variability in the number of data points was the result of student absence from class.)

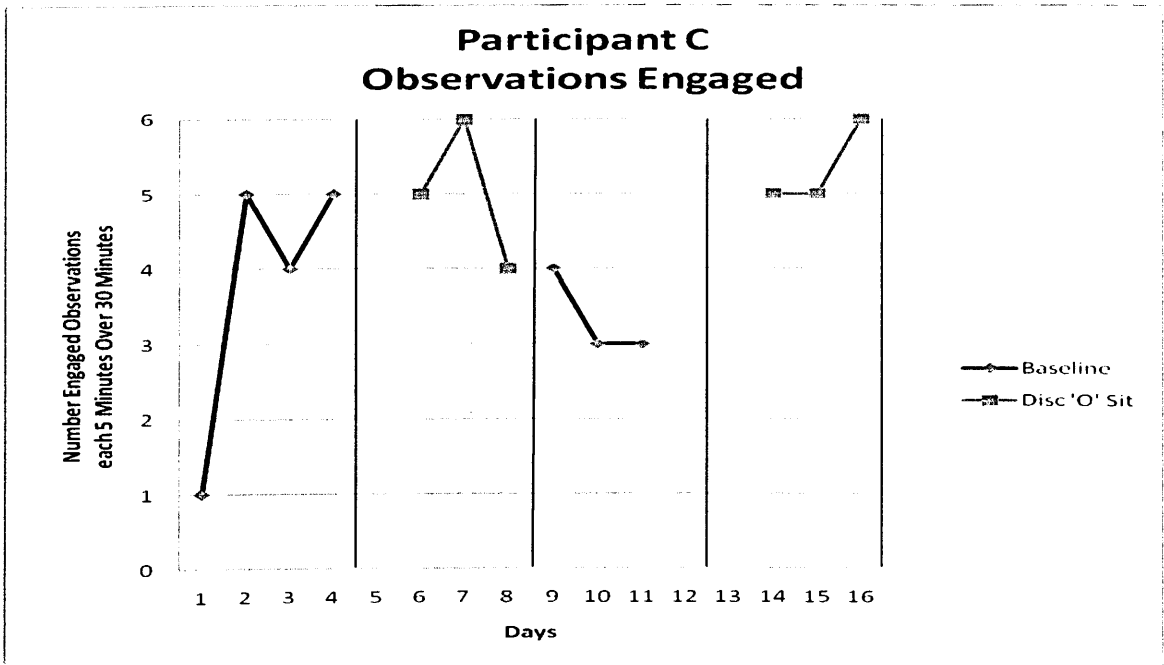


Figure 6. Number of engaged observations each five minutes over 30 minutes during language arts activities by session. (Variability in the number of data points was the result of student absence from

## CHAPTER V

### DISCUSSION

The purpose of this study was to investigate the effectiveness of using a Disc ‘O’ Sit, a dynamic seating device, on improving third grade students with ADHD’s on-task behaviors while engaged in a language arts task in the classroom. The results of this study were found to be inconsistent amongst the three target students. While the inconsistent results were unable to provide inconclusive evidence that Disc ‘O’ Sit cushions increase on-task behaviors of third grade students with attention difficulties, the results do indicate that the use of the Disc ‘O’ Sits did produce positive changes in the in-seat behavior of one out of the three of the target students and possibly impacted the engagement behavior of another one of the three target students. The results varied for each student and none of the three target students demonstrated substantial improvements in both areas. For one of the target students, the increase in the on-task behavior of engagement in the task that occurred during the two intervention phases was not maintained when the use of the Disc ‘O’ Sits were withdrawn. For another target student, the increase in in-seat behavior that occurred with the use of the Disc ‘O’ Sit was not maintained when the Disc ‘O’ Sit was not used by that student. Rather, the increase in the specific behavior returned to baseline levels when the Disc ‘O’ Sits were not used. This provides support for the use of the dynamic seating devices in the classroom to increase the on-task behaviors of remaining

seated and engaged, although results may vary amongst different students and positive effects may not necessarily be seen in both areas.

When looking at Student A's data, the graphs do not show a consistent pattern between the baseline and intervention phases. It could be expected that his initial positive increase in in-seat behavior during the first intervention phase would be seen along with an increase in engagement behaviors as well. His in-seat behavior was noted to be slightly higher and more consistent with the use of the Disc 'O' Sit, however, a significant change was not noted. His engagement behaviors, while they did not fluctuate as much during intervention as they did during baseline, did not show immediate and consistent improvements during the intervention phases. Student A's medication changes throughout the study possibly impacted his on-task behaviors as well during the study, making it difficult to discern if the dynamic seating intervention positively impacted his on-task behaviors. His teacher reported that of the three target students, she saw the least amount of positive impact with the use of the Disc 'O' Sit with Student A.

Student B demonstrated an immediate increase in in-seat behaviors during both intervention phases. He was observed to not get up out of his seat as often with the use of the Disc 'O' Sit. He was also observed to sit on his bottom and remain in the same position for longer periods of time during the intervention phases. Without the use of the Disc 'O' Sit, he tended to get up out of his seat frequently, often changed positions, tipped his chair or sat with one leg and foot under his bottom. While his in-seat behavior improved during the intervention phases, his engagement behaviors did not show a consistent pattern of improvement with the use of the Disc 'O' Sit. For Student B, his

ability to remain in his seat for longer periods of time, did not necessarily correlate to an increase in engagement in the task at hand while seated. Rather, he continued to have some difficulty initiating and remaining engaged in the task at hand. His teacher did report that she felt Student B demonstrated some improvements with attending and completing tasks along with the decrease in fidgeting and disruption to others.

Student C did not have as much difficulty as Student B in remaining in his seat prior to use of the Disc ‘O’ Sit cushions. His graphs for in-seat behavior do not show a consistent pattern between phases and no distinct change in in-seat behaviors was noted during the study. Student C’s data, however, did show a possible positive change in engagement behaviors with the use of the Disc ‘O’ Sit. When the intervention was withdrawn, his engagement behaviors decreased, followed by an immediate increase when the intervention was re-introduced. Student C was absent for three observations sessions, therefore making it difficult to state that the use of the Disc ‘O’ Sit cushion had a definite positive impact on his engagement behavior. His teacher reported that she felt he demonstrated improved attending and task completion along with a decrease in fidgeting and disruptiveness to others with the use of the Disc ‘O’ Sit.

### Limitations

While the results of this study provide support for the use of Disc ‘O’ Sit cushions as a seating option for children with ADHD, caution must be taken not to over-generalize the findings due to the limitations of this study. Results of this study were limited by the short duration (eight weeks), use of a single classroom and use of a behavioral observation form that is not a developed assessment tool. The small sample size of three

students, all male with a diagnosis of ADHD or history of attention difficulties within the classroom, was not extensive enough to generalize the effects observed in this study across a broader range of children with ADHD or to children with other conditions which may affect their attention to task. Another limitation included lack of blinding of the teacher who was aware who was being observed for this study and one observer was utilized for data collection; therefore, observer bias may be present. However, the behavioral observation tool utilized was easy to use and objective in order to control for the possibility of observer bias. The teacher and observer were aware of which students received the intervention because the use of the Disc 'O' Sit cushions were be visible. Therefore, the possibility of experimental bias may exist. Although the teacher reported improvements in class work when the students were seated on the Disc 'O' Sits, formal assessment of the language arts assignments in areas such as spelling, legibility, content or quantity of written work produced was not completed.

#### Future Research

The use of Disc 'O' Sits within the classroom setting needs to be further investigated. The longitudinal effects of using Disc 'O' Sits as a dynamic seating option for a broader range of students with ADHD, as well as the use with children with other diagnoses merits further study. Study of the effects of this intervention over time by collecting data over a longer period, along with use of a larger sample size, is needed to generalize the findings to a larger population. Future research is also needed to determine the impact the use of this intervention has on academic performance. While this study measured the students' engagement in language arts tasks, it did not analyze the work

produced while seated on the Disc 'O' Sits. While the general education teacher did express towards the completion of the study that she would like to see if there was a change in the amount of written work completed by the target students while seated on the Disc 'O' Sits, we were unable to analyze their written work in their daily journals for differences between study phases as none of the target students had dated their journal entries. Future research could include measurement of variables such as quality or quantity of work production, written legibility or student performance in additional academic areas.

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APPENDIX A

Behavior Observation Form

## Appendix A

### Behavior Observation Form

<b>Student:</b>						
<b>Activity:</b>						
<b>Time:</b>	5'	10'	15'	20'	25'	30'
<b>On-task:</b>						
<b>In-seat</b> <ul style="list-style-type: none"> <li>• any portion of buttocks in contact with seat/cushion</li> <li>• four legs of chair in contact with floor</li> </ul>						
<b>Engaged</b> <ul style="list-style-type: none"> <li>• following direction</li> <li>• body oriented to activity</li> <li>• visually attending</li> <li>• interacting with materials</li> <li>• responding/looking at speaker</li> <li>• oriented to/ responding to peers appropriately</li> </ul>						
<b>Off-task:</b>						
<b>Out-of-seat</b> <ul style="list-style-type: none"> <li>• no portion of buttocks in contact with seat/cushion</li> <li>• less than four legs of chair in contact with floor</li> </ul>						
<b>Non-engaged</b> <ul style="list-style-type: none"> <li>• NOT following direction</li> <li>• body NOT oriented to activity</li> <li>• NOT visually attending</li> <li>• NOT interacting with materials</li> <li>• NOT responding/ looking at speaker</li> <li>• NOT oriented to/ responding to peers appropriately</li> </ul>						

APPENDIX B

Student A Behavioral Data

Appendix B  
Data

	Student A	In-Seat	Engaged
Phase1	Fri	6	1
Baseline	Wed	5	3
	Fri	4	1
	Mon	6	5
Phase2	Wed	6	4
Intervention	Fri	6	4
	Wed	6	5
	Wed	6	5
Phase3	Fri	4	2
Baseline	Wed	4	0
	Fri	6	5
	Wed	5	3
Phase4	Fri	5	2
Intervention	Wed	6	3
	Fri	5	4
	Wed	6	5

APPENDIX C

Student B Behavioral Data

Appendix C  
Data

	Student B	In-Seat	Engaged
Phase1	Fri		
Baseline	Wed	3	5
	Fri	3	3
	Mon	4	4
Phase2	Wed	5	5
Intervention	Fri	6	3
	Wed	6	2
	Wed	6	6
Phase3	Fri	5	3
Baseline	Wed	4	1
	Fri	2	3
	Wed	2	4
Phase4	Fri	6	4
Intervention	Wed	6	3
	Fri	4	5
	Wed		



APPENDIX D

Student C Behavioral Data

Appendix D  
Data

	Student C	In-Seat	Engaged
Phase1	Fri	6	1
Baseline	Wed	5	5
	Fri	6	4
	Mon	6	5
Phase2	Wed		
Intervention	Fri	5	5
	Wed	6	6
	Wed	6	4
Phase3	Fri	4	4
Baseline	Wed	4	3
	Fri	5	3
	Wed		
Phase4	Fri		
Intervention	Wed	6	5
	Fri	5	5
	Wed	6	6