MOVEMENT AND ATTENTION: AN EXAMINATION OF THE RELATIONSHIP BETWEEN MOVEMENTS AND ADHD MANIFESTATIONS IN MIDDLE SCHOOL STUDENTS WITH ADHD

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Abstract

Students with Attention deficit hyperactivity disorder (ADHD) exhibit behaviors such as hyperactivity, inattention, and impulsivity. These behaviors, a result of the disorder, can cause students to struggle academically, socially, and emotionally. Although several studies have investigated the role and possible benefits of movement in learning, there are a limited number of studies focusing on the effects of movement-integrated interventions on the frequency of ADHD-related behaviors. The purpose of this study was to examine the relationship between movement and the number of ADHD-related behaviors. This single-subject study utilized a qualitative research design at an East Tennessee middle school. The researcher observed students diagnosed with ADHD in the standard classroom environment in order to record the number of ADHD-related behaviors exhibited. The researcher recorded these behaviors before and during the treatment, which is the integration of structured and unstructured movement into instruction.

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CHAPTER 1

Introduction

Attentional deficit hyperactivity disorder (ADHD) is becoming increasingly prevalent in students, and it is a disorder for which there is no cure. Manifested through behaviors characterized by hyperactivity, inattention, and impulsivity, ADHD certainly affects students socially, emotionally, and academically (Centers for Disease Control and Prevention, 2014). The standard classroom stands in direct opposition to these behaviors, encouraging behavior that is quiet, still, and sedentary (National Resource Center on ADHD, 2016).

Teachers in the classroom, tasked with meeting the needs of all students, undoubtedly feel frustrated and underprepared when working with a student with ADHD (Ek, Westerlund, Holmberg, & Frenell, 2011). Students with ADHD experience challenges academically through lower test scores as well as socially through isolation from their peers (Ozdemir, 2010). These challenges can persevere through adolescence into adulthood and can often lead to depression and anxiety (Barkley, 2015). In order to circumvent these outcomes, students with ADHD need the support of their teachers and access to strategies conducive to their unique learning needs. Provided with the right environment and equipped with the right tools, these students can experience success.

Research shows a connection between movement and learning (Middleton & Strick, 2001). Students who move more frequently in school show improved classroom behavior and improved academic outcomes (Dwyer, Sallis, Blizzard, Lazarus, & Dean, 2001). Students with ADHD could benefit from strategies in the classroom that provide stimulation, such as movement, to aid in their success at school.

Background of the Study

Although ADHD has become increasingly prevalent in schools over the past several years, most teachers are not prepared to meet the needs of these students (Ek, Westerlund, Holmberg, & Frenell, 2011). This is, in part, due to a lack of research regarding strategies to meet the needs of these learners. Because ADHD is a heterogeneous disorder, a disorder that looks different for each individual, different strategies are needed based on individual needs and manifestations of the disorder (Brown, 2016; Reiber, & McLaughlin, 2004). Teachers are aware of the behaviors associated with ADHD, but lack an understanding of how to address these behaviors in a way that will help these students experience success (Harazni & Alkaissi, 2016).

Several studies on the use of movement in the classroom as a strategy to manage student behavior have recently been completed (Hallowell & Ratey, 2005). The research shows exercise not only enhances the ability to recall information, it motivates students to listen, engage, and pay attention (Corbin, 2008; Vanynman, Shoshanna, Ying, & Gomez-Pinilla, 2004). In keeping with the Optimal Stimulation Theory, allowing students the freedom of movement in the classroom will also provide additional stimulation, keeping students from seeking stimulation elsewhere (Zentall, 1975).

Recent research on the attention span of students with ADHD when seated on exercise balls found students to show increased time on-task when using these alternative seats (Sarver, Rapport, Kofler, Raiker, & Friedman, 2015; Wu et al., 2012; Schilling, Washington, Billingsley, & Deitz, 2003). There is a lack of research, however, regarding the use of other movements in relation to an ADHD students' attention span. The need for useful strategies is pressing for both teachers and students, and additional information

is needed regarding the use of movement in the classroom with students with ADHD.

Statement of the problem

Students with ADHD are spending the majority of their day in school, which typically consists of a sedentary environment. Although students' ADHD is manifested in different ways, research suggests many students are exhibiting these ADHD-related behaviors as a search for stimulation (Zentall, 2005). Students are not reaching their optimal level of stimulation in class, so they are seeking it through hyperactivity, impulsivity, or inattention (Zentall, 2005**).** However, teachers see these behaviors as distracting, irresponsible, and working against the students' efforts. This situation can spiral into a vicious cycle in which both students and teachers become frustrated and feel their attempts to be successful in the classroom environment are continually thwarted. While research on the relationship between movement and learning abounds, there is little research on the relationship between movement and the attention of students with ADHD.

Purpose of the study

Many studies have shown a link between movement and learning, and several recent studies have focused on studying the relationship between movement and students with ADHD. The purpose of the study is to examine the relationship between structured and unstructured movement opportunities and number of ADHD-related movements in students with ADHD in a classroom environment. Ultimately, teachers need more information and specific strategies to use when working with students with ADHD, and the results of this study could help to close this gap in the research.

Theoretical foundation

The Optimal Stimulation Theory is based on the belief that each individual is seeking to attain an optimal level of stimulation in any given circumstance (Zentall, 1975). This theory holds if the setting is under-stimulating, individuals will seek additional stimulus to reach the desired level. If the setting is over-stimulating, individuals will seek to decrease stimulus to reach the desired level (Zentall, 2005). Each individual maintains a unique level of optimal stimulation, so what might be the most conducive educational environment for one individual could be an over-stimulating environment for another.

As it relates to ADHD, the Optimal Stimulation Theory serves to explain the basis of hyperactive and impulsive behavior as a means to increase stimulus for individuals seeking their optimal level and the basis of inattentive behavior as a means to decrease stimulus. This stands in stark contrast to many previous theories which have maintained that hyperactivity is a result of excess hyperactivity (Zentall, 1975). This theory functions as the foundation for this study, as the researcher aims to investigate the relationship between movement and the number of ADHD-related behaviors in students with ADHD. Research has shown hyperactivity has occurred in students during periods of waiting or sitting still in a chair, suggesting these students are exhibiting hyperactive behaviors in order to increase stimulation (Zentall, 1974). Data from previous studies using the Optimal Stimulation Theory as a theoretical basis have flooded students' environment with stimuli in the form of music, color, and movement; the results of the studies showed students' hyperactive behavior decreased in this environment (Cromwell & Foshee, 1960). Based on the Optimal Stimulation Theory, if students with ADHD are provided

with stimulation, such as movement, the need to create their own stimulation through hyperactivity or inattentiveness could decrease, and on–task behaviors could increase.

Research questions

Based on the review of literature, the researcher has posed the following questions:

1. What is the relationship between movement and the amount of ADHD-related behaviors in students diagnosed with ADHD?

2. What is the variation in the hyperactive behavior of students with ADHD when structured versus unstructured movements are incorporated?

Hypothesis

The researcher hypothesized if students with ADHD are provided with stimulation through activities providing for movement, the stimulus-seeking behaviors will decrease.

Limitations

One limitation of this study was in the area of external validity, as generalization was difficult with the use of only a few subjects. Generalization was limited to students with ADHD in sixth grade in an East Tennessee middle school. In addition, random selection and random assignment were not used, as ADHD is a non-controlled variable. The population was selected specifically for the ADHD trait. Because ADHD is a heterogeneous disorder, results varied by individual preferences and manifestations of the disorder.

Delimitations

The student sample population consisted of students in sixth grade who have been

diagnosed with ADHD. The types of movements used were specifically selected by the researcher in order to confirm previous research studies (seated on exercise balls) as well as to experiment with untested methods (use of bouncy bands, structured movements and class stretches). The student sample was made up of several different ethnicities and both genders in order to account for variability. The study did not account for medication or other types of therapy that could be linked to any observed differences. Because this study was a single-subject design, each student served as his or her own control, bypassing the error of inter-subject variability.

Definitions of terms

Movement*:* For the purposes of this study, movement is defined as an action in which the individual is moving a part of his or her body, such as their legs, hands, or arms. A distinction between structured and unstructured movement was made in this study.

Structured movement*:* This refers to any motion made by an individual as directly initiated by the instructor, such as stretching, light exercises (i.e. jumping jacks, spinning in circles), standing, or sitting. For the purposes of this study, these types of movements will include brain breaks led by the teacher.

Unstructured movement: This refers to any motion made by an individual, either consciously or unconsciously, when given a manipulative. For the purposes of this study, these types of movements included motions made while seated on an exercise ball (i.e. rocking, bouncing, balancing, kneeling) and motions made while an individual's feet are resting on a bouncy band (bouncing, kicking, stretching, tapping, swaying).

Brain breaks: This refers to the moments during instruction in which the

instructor purposefully stops the lesson in order to allow students a time to engage in physical exercise through stretching (Desautels, 2016).

Bouncy band: These are thick rubber bands specifically designed to accommodate the legs of a student desk. These bands stretch across the bottom of a student desk in order to create tension on the band and allow students to engage the band with their feet. They are specifically designed to provide students with an outlet for pent-up energy while seated in class (Therapro, 2016).

Exercise ball: For the purposes of this study, this term refers to a large plastic ball pumped full of air and used in place of a standard desk chair (Gaiam, 2016).

Attention: This term refers to the act of concentrating, listening to, following instructions, or watching something or someone (attention, 2015). For the purposes of this study, one unit of attention will be equivalent to the act of concentrating, listening, following instructions, or watching uninterrupted for a duration of five seconds.

Hyperactivity*:* This refers to the state of being excessively or pathologically active (hyperactivity, 2015). For the purposes of this study, one unit of hyperactivity will be equivalent to the act of manifesting a hyperactive behavior for a duration of three seconds. A hyperactive behavior includes a student squirming, bouncing, or moving in his seat; getting out of his chair during instruction; blurting out; talking at inappropriate times; fidgeting with hands or feet; or having difficulty waiting his turn.

Inattentiveness*:* This term refers to the act of not paying attention (inattentiveness, 2015).

ADHD-related behaviors: This term refers to the acts of interrupting/blurting out, fidgeting, squirming, difficulty sitting still, playing with objects, daydreaming, and

difficulty focusing and remaining attentive to tasks (National Resource Center on ADHD, 2016).

On-task behaviors: This term refers to following instructions on the first request, attending to classroom discussions and directions, participating in classroom discussions, taking notes with the class, completing assignments, and focusing on the task at hand.

Tally: Each individual tally will account for one occurrence of one behavior. One occurrence of hyperactivity will refer to the operational definition for the duration of three seconds. One occurrence of attention will refer to the operational definition for the duration of five seconds.

Students with ADHD*:* These are students who have been formally diagnosed with ADHD prior to this study.

Inclusion: This refers to the act of students with disabilities being incorporated into a standard classroom..

Full Class Period: This is a 60-minute class period designated for English Language Arts.

Classroom environment: A standard classroom environment is considered one in which students are seated at desks, receiving information from the teacher, and receiving tasks to complete.

ELA: English Language Arts; a curriculum focusing on reading, writing, and grammar.

Organization of the Study

This study is presented in five chapters. The first chapter is an introduction to the study. It provides a context, a background for the study, and explains the theoretical

foundation. This chapter also defines key terms, identifies the research questions, and explains the significance of and need for the study. The second chapter presents a review of the literature related to the study. The literature reviewed examines the diagnosis of ADHD and its effects on students, as well as movement and its relation to attention. The third chapter provides a detailed description of the methods and procedures used in conducting the study, including the research design, the population and sample, tools and procedures for data collection, limitations and delimitations, and analysis. The fourth chapter contains the results of the study while the fifth chapter summarizes the findings and concludes by discussing the implications and recommendations for future research.

CHAPTER 2

Literature Review

Attentional deficit hyperactivity disorder (ADHD) was the most commonly diagnosed behavioral disorder of the 20th century. Pediatricians, parents, and teachers are aware of the disorder and the accompanying symptoms: hyperactivity, impulsivity, distractibility, inattentiveness, and lack of focus. Medical notes on ADHD can be traced back to the early 1900s; a pediatrician described children who were fidgety, had serious issues with attention, and could not sit still (Myttas, 2001). Although many professionals agree on a combination of pharmaceutical treatment and behavior management to treat ADHD, studies show the effects of such interventions are short-lived. With more and more students receiving the ADHD diagnosis, the need for effective mediation continues to grow.

Theories regarding ADHD

Brain-based theory holds that one learns best when one encounters academic material in a manner that agrees with the natural tendencies of the brain rather than against them (Duman, 2010). Long have regions of the brain been studied to discover their individual roles in relation to memory and learning, and scientists are constantly gathering new information regarding connections between regions. The region of the brain that processes movement is the same region that processes the movement of thought: the cerebellum (Strick, Dum, & Fiez, 2009). An integral discovery in the makeup of the brain-based theory, the fact that the brain is active during movement and thinking, has lead scientists to further investigate neural firing in relation to movement.

Simple movements, such as walking, result in neural firing in the brain. Kinesthetic movement, even in small capacities, increase brain activation; brain activation is necessary for thinking and learning. One of the benefits of movement is the release of hormones, including hormones that affect attention spans (Jensen, 2005).

Students are individuals, and no two students learn in exactly the same way. Gardner (1983) proposed students possess different types of minds, and therefore learn in different types of ways. His theory of multiple intelligences provided seven different learning styles. One of the best ways of understanding individual differences is through understanding learning styles. Research has revealed that students learn in different ways; therefore, multiple modalities of learning should be provided (Gardner, 1983). According to Kolb (1984), it is beneficial for students when they are provided with activities that are in accordance with their learning styles. When information is delivered in such a way that it is in compliance with the way an individual's brain works, the student benefits in the areas of motivation, positive attitude, and academic achievement (Sousa, 2006).

According to the brain-based learning theory, diverse learners need differentiated strategies to accommodate a variety of styles for learning (Sousa, 2006). If students become aware of how they learn, they can pursue learning in this way in future settings. Students who gained awareness of their learning style experienced an improved self-concept and increased motivation (Bandura, 1997). Students with ADHD, in particular, could benefit from understanding their own learning style and the reasons behind their behavior. Reasonable evidence has pointed to kinesthetic learning as a good fit for students with ADHD as they seek out stimulation, and kinesthesis provides stimulation to both the body and the brain (Jensen, 2005).

Optimal Stimulation Theory

When organisms are hungry, they seek food. The Optimal Stimulation Theory (OST) expressed an individual's desire for stimulation in much of the same way. Also referred to as the Arousal Theory, OST suggested an individual seeks to maintain an ideal level of stimulation through stimulation-seeking activity. The optimal level can vary by individual. In general, many individuals seek out stimulation such as entertainment when they are bored. When individuals are overstimulated, this can result in stress or anxiety. As a result, individuals seek to reduce stimulation and seek out activities that will be relaxing (Zentall, 2005).

For students with ADHD, when stimulation falls below a desired level, additional stimulation is sought (Zentall, 2005). OST suggested hyperactive behavior functions to optimize stimulation, not as a result of too much stimulation (Zentall, 1975). If activity is a result of an individual's desire for increased stimulation, Douglas suggested "we keep our minds open to the possibility that the presence of stimulation and/or hyperactive behavior may sometimes help maintain alertness and thus improve attention in some children" (Douglas, 1974, p.64).

Data from research indicates that students exhibiting hyperactive behaviors are doing so in environments in which their optimal stimulation level has not been met. For example, many teachers reported the most incidents of hyperactivity during periods of inactivity such as waiting while seated in a chair (Zentall, 1974). However, hyperactivity was not noted during periods of excessive stimulation such as recess, group talk, or during free time. This evidence directly supports the OST through implying tasks with

little to no stimulation promote greater hyperactivity than tasks with involving visual, auditory, and kinesthetic stimulation (Zentall, 1974).

Data has shown students with ADHD performed poorly when stimuli were presented slowly (Johnson, Wiersema, & Kuntsi, 2009). They showed a rapid decline in task efficiency over time when information was presented slowly, but not when information was presented rapidly. This supports the idea that when academic information fails to stimulate them accordingly, students with ADHD seek to create their own stimulation.

Rather than reduce stimuli, as many school-based treatments have suggested, OST suggested increasing stimuli through medication, physical activity, or sensory input (Zentall, 2005). In a classroom setting, teachers cannot control whether or not a student is stimulated through medication. They can, however, control the stimulants of physical activity and sensory input. Results of one study showed hyperactive students can be calmed by being placed in a highly stimulating environment at school; the stimulants can take the form of music, color, movement and interaction. In this environment, students' symptoms decreased (Cromwell & Foshee, 1960).

Previous educational theorists have suggested reducing stimuli will promote attentiveness and decrease distractibility (Cruickshank, 1961). However, research findings by Zuk (1963) measuring the effectiveness of this theory have noted students are "invariably attracted by moving stimuli," and are not distracted when moving in an automobile or watching a film, even though the background stimulus in both of these environments, under this theory, should serve to distract them further. In addition, when students with ADHD were in isolated environments away from their peers and the

"distracting" stimuli of the classroom, it was noted these students created their own stimulus through playing with materials (Antrop, Roeyers, Van Oost, & Buysse, 2000). This further propagates the idea that students with ADHD are searching for stimuli.

In an attempt to assess the effect of a child's environment on stimulation creation, thirty hyperactive children and thirty non-hyperactive children were placed in a situation where wait time was created. The hyperactive children who were not given stimulation during this time created stimulation for themselves. The non-hyperactive children did not create stimulus for themselves. There was no difference between the behaviors of the hyperactive children and the non-hyperactive children who were provided with stimulation during their wait time. The results of this study support the OST through the production of stimuli by the hyperactive children in the absence of any other stimulation (Antrop, Roeyers, Van Oost, & Buysse, 2000).

In further support of OST, students with attentional difficulties who engaged in fine motor manipulation of tactile objects while answering math problems showed an increase in task completion and a decrease in excessive motor movement (Kercood, Grskovic, Lee, & Emmert, 2007). It would seem these students with attentional difficulties could have been searching for additional stimulation through their excessive motor movements. Working with a tactile object provided them with an optimal level of stimulation, therefore decreasing the motor movements.

The notion that students with ADHD have difficulty waiting because they are seeking additional stimulation is supported by the delay aversion theory. With delay aversion, a child experiences difficulty waiting, and often chooses immediacy even to his disadvantage (Laver-Bradbury, 2011). This delay aversion can result in a child choosing

an immediate stimulation, like fidgeting or playing, while waiting for instruction in the classroom environment (Laver-Bradbury, 2011).

Delay Aversion Theory

Delay Aversion Theory, originally described in the 1990s by Sonuga-Barke & colleagues (1992) defined a behavioral tendency to choose a smaller immediate reward in order to experience instant gratification rather than choosing a greater reward that would be delayed (Palovelis, Asherson, & Kuntsi, 2009). A recent study tested the preferences of students with ADHD in choosing between an immediate smaller reward and a delayed greater reward. The results of the study showed students with inattention displayed a greater tendency to choose the immediate reward than students with hyperactivity. This theory is related to a motivational account of ADHD-related behavior rather than focusing on cognitive deficits.

Definition of ADHD

Attention Deficit Hyperactivity Disorder (ADHD) is a condition in which affected children exhibit behaviors characterized by problems with attention, impulsivity, and overactivity. ADHD is becoming more and more prevalent in children in the United States of America. In children ages 11-14 years, one in nine have been diagnosed with ADHD (Centers for Disease Control and Prevention, 2014). Students who have been diagnosed with ADHD and attending public schools may be eligible to receive services under Section 504 of the Rehabilitation Act or Individuals with Disabilities Education Act (IDEA). These laws provide special services and accommodations for students with disabilities in order to provide them with a free and appropriate education ("Statistical Prevalence," 2014).

According to the National Resource Center on ADHD, students with ADHD might exhibit behaviors in the classroom such as interrupting and blurting out, fidgeting, squirming, difficulty sitting still, and difficulty focusing and remaining attentive to tasks. Students with ADHD may also be affected by other disorders such as disruptive behavior disorders, mood disorders, anxiety disorders, tics and Tourette syndrome, and learning disabilities (National Resource Center on ADHD, 2008). Dr. Archer (2015), ADHD expert and author, describes the disorder aptly as a brain with a very low boredom threshold. Despite the rising numbers of diagnoses, the cause of ADHD remains unknown (Thapar et al., 2013).

History of ADHD

Although ADHD was not be considered for addition to the American Psychiatric Association's Diagnostic and Statistical Manual, Fifth edition (DSM-V) until recently, texts documenting the struggle with short attention spans date back to the 1700s. German physician Melchoir Adam Weikard discussed treatment for an inattentive person: he is to be separated from noise, other objects, any other stimulation, and kept in solitary when he is too active (Schwarz, 2016). Later, in 1845, another German physician gave merit to inattentiveness in children with his alliterative children's rhyme considering "Fidgety Philipp," who "won't sit still; he wriggles…swings backwards and forwards…tilts up his chair" (Schwarz, 2016).

One of the first medications found to alleviate these symptoms was discovered, quite by accident, at a home for children with significant behavior deficiencies. The resident physician administered a drug to treat severe headaches. The headaches remained, but an unexpected side effect appeared. The students were focused, attentive,

and showed an improved reaction and processing time. In the 1960s, a similar drug with the brand-name of Ritalin was developed. Since then, ADHD has been referred to by many different names: minimal brain damage, hyperkinetic impulse disorder, attention deficit disorder(ADD) and attention deficit hyperactivity disorder (Laufer, Denhoff, & Solomons, 1957). Although ADD has been used in the past to provide distinction between attention disorders that are primarily manifested by hyperactivity and those that are primarily manifested through inattention, the DSM-V considers ADHD to be the all-encompassing term.

Diagnosis of ADHD

Gender Differences

ADHD is more frequently identified in males than females (Soffer, Mautone, & Power, 2008). In fact, males are three times more likely to be diagnosed with ADHD than females (Grskovic & Zentall, 2010). ADHD can also be manifested differently in individuals. ADHD can be manifested through predominant inattentiveness (ADHD/I), predominant hyperactivity-impulsiveness (ADHD/H), or a combination of both (ADHD/COM) (Center for Disease Control, 2016). However, when compared to the control group, individuals diagnosed with predominant inattentiveness displayed more fidgety, restless movements (Lahey, Pelham, Loney, et al., 2005).

The prevalent diagnosis of boys with ADHD could be due to the fact that, when diagnosed, boys are more typically diagnosed with ADHD/COM and girls are more typically diagnosed with ADHD/I. Teachers, parents, and peers could be more likely to notice hyperactivity than inattention, therefore accounting for this difference. There are significant differences in the manifestation of ADHD according to gender. Although boys

with ADHD have often been found to have a reading disability, girls with ADHD, according to Soffer, Mautone, & Power (2008), showed no significant affectation. Another finding showed girls with ADHD/COM displayed greater social difficulty than girls with ADHD/I; however, girls with ADHD/I were perceived by their peers as more isolated (Soffer, Mautone, & Power, 2008).

Diagnostic Tools

ADHD should be assessed through a clinical interview with parents and the child, a report from the child's school regarding academics as well as social and behavioral functioning, and standardized ratings from parents and teachers regarding behaviors. This diagnostic evaluation should show whether or not the student meets the criteria for an ADHD diagnosis as well as identify the areas of impairment (Soffer, Mautone, & Powers, 2008).

There is no single test for diagnosing ADHD. In order to accurately diagnosis ADHD, according to the American Psychiatric Association (2013), an individual must meet six of the criteria listed under symptoms of ADHD in the American Psychiatric Association's Diagnostic and Statistical Manual, Fifth edition (DSM-V), the most widely used diagnostic criteria in the United States, for a period of at least 9 months. In addition, behavior rating scales must be completed by adults in the child's life from at least two separate environments, such as home and school. Documentation of direct observations of students in the classroom must be made, and interviews with parents and teachers ensure a thorough analysis of multiple data points in order to administer a precise diagnosis (DuPaul, 2003).

The criteria listed in the DSM-V was specifically developed in order to distinguish ADHD from other disorders in children. ADHD is unique in its diagnosis, as it necessitates a cluster of symptoms rather than an absence or presence of symptoms; it is also set apart due to its intensity and persistence (Goldstein & Naglieri, 2008). ADHD has been described as "not an all-or-nothing" disorder (Brown, 2016); Unlike diagnoses such as pregnancy, where one either is or is not pregnant, ADHD can develop anywhere along the continuum of symptoms.

In addition, the high rate of comorbidity can complicate the diagnosis of ADHD as well as the treatment (Goldstein & Naglieri, 2008). Some of the functional impairments or psychiatric conditions often found to be comorbid with ADHD include emotional functioning (e.g. anxiety, depression, bipolar disorder), neuropsychological functioning (e.g. temporal processing deficits), disruptive behavioral disorders (e.g. oppositional defiance), and tic disorders (e.g. Tourette syndrome) (Tarver, Daley, & Sayal, 2014; Faraone & Kunwar, 2007).

There are several rating scales available for use both at home and at school, such as Barkley Deficits in Executive Functioning Scale (Barkley, 2011), the Brown ADD Rating Scale for Adults (Brown, 1996), or the Connors Adult Attention Rating Scale (Connors, Erhardt, & Sparrow, 1999); these scales have been vetted in order to ensure validity and reliability in producing data toward a diagnosis (McCandless & O'Laughlin, 2007). Some researchers associate Brown's scale with predominant inattention and Connors' scale with predominant hyperactivity and impulsivity (Wasserstein, 2005). The results of a ten-year review of these scales showed them to be adequate measures of symptoms of ADHD (Collett, Ohan, & Myers, 2003).

One of the most popular scales specifically used for teacher reports is the Connors Behavioral Scale. The scale includes the child's perceptions of their own behaviors in the data analysis, which could also produce data in relation to the effectiveness of treatments over time (Erickson, Clark, & Kohn, 2010). ADHD is not the only disorder associated with hyperactivity, inattention, and impulsivity. This can cause difficulties in diagnosing ADHD or misdiagnosing a student with a disorder that possesses similar characteristics (Levy, Hay, Bennett, & McStephen, 2004).

Effects of ADHD

Recent research suggested brains of students with ADHD experience a three-year developmental lag behind their peers (NIHM, n.d.). In contrast, their motor cortex, the area of the brain responsible for generating neural impulses controlling movement, develops more quickly. This advanced development could potentially attribute to one of the symptoms of ADHD, increased motor activity (U.S. Department of Education, 2009).

Social and Emotional Impact

One of the outstanding differences in students with ADHD is found in executive functioning. Executive functions are the mental control processes responsible for planning, working memory, foresight, response inhibition, and cognitive fluency. From a neuropsychological perspective, executive functioning refers to a narrow set of fundamental neurological processes necessary for "independent" and "socially responsible" living (Lezak, 1982). When studying the differences in executive functioning between thirty healthy individuals and thirty individuals diagnosed with ADHD, researchers found the individuals with ADHD to show significant deficits (Sinha, Sagar, & Mehta, 2008). According to the National Institute for Health (2003), students

with ADHD are more likely as adolescents to be in a motor vehicle accident, use tobacco products, and experience teenage pregnancies.

Students diagnosed with ADHD often experience a negative impact on their social life, as they can have difficulties interacting with adults and responding appropriately to authority, as well as maintaining friendships with peers (Stormont, 2001). Their slower reaction time and processing can cause gaps in conversations, and these students are often rejected by their peers (Hoza, 2007; Licari & Larkin, 2008). Students with ADHD may often be considered socially awkward and perceived as annoying (Colombo-Dougovito, 2013).

Not surprisingly, these social difficulties can have emotional impacts; children with ADHD are at a higher risk to develop depression and anxiety disorders (Barkley, 2015). This occurs more frequently among females with ADHD. Among clinically referred children with ADHD, females were more anxious and withdrawn (Kearns & Ruebel, 2008). A recent study comparing girls with ADHD to their non-diagnosed peers found the girls with ADHD were characterized as becoming bored more easily, had difficulty waiting, were more verbally impulsive, and demonstrated emotions such as anger and stubbornness more frequently than their peers (Grskovic & Zentall, 2010).

In addition to a slower processing and reaction time, students with ADHD also perceive social and emotional cues differently and incompletely, possibly due to inattention (Ozdemir, 2010), which only compounds their difficulties socially (Licari & Larkin, 2008). This difference between gender in students with ADHD continues through adolescence and into college. A researcher investigating the relationship between negative emotion and ADHD in college males and females found that females self-

reported significantly more negative emotion than their male counterparts. In addition, both male and female college students self-reported more negative emotion than their non-ADHD peers (Kearns & Ruebel, 2008).

Poorly regulated emotions is also a struggle many students with ADHD face (Barkley,1997). Higher levels of stress were self-reported among students with ADHD than students without. Lower levels of cortisol were found in students with ADHD, as compared to their peers; these students may manage higher levels of stress from an early age, and could be exhausting the HPA axis, the body's stress regulatory system. The results of this study showed students with ADHD were not experiencing less stressful situations, their bodies just did not react to these situations in the same way others did (Isaksson, Nilsson, & Lindblad, 2013).

Academic Implications

Students with ADHD are likely to have performance deficits in several areas, specifically in reading and mathematics (Alvarado, Puente, Jimenez, & Arrebillaga, 2011; Loe & Feldman, 2007). In some cases, students with ADHD experienced environmental frustrations and under-achievements significant enough to cause them to drop out of school (Vostal, Lee, & Miller, 2013). In response to these frustrations, common interventions for students diagnosed with ADHD have included use of remedial academic services, tutoring, special education services, and after-school programs (Loe & Feldman, 2007). These students were also more likely than their peers to be expelled, suspended, or repeat a grade (LeFever, Villers, Morrow, & Vaughn, 2002). Students with ADHD have been shown to possess a reduced sensitivity to mistakes, poor rule-governed

behavior and self-regulation of emotion, and problems with self-regulating and planning or anticipating outcomes and consequences (Barkley, 2003).

Students with ADHD may experience difficulties in the school environment, as the very nature of their disorder results in behavioral manifestations. These difficulties have been shown to have long-lasting effects that impact the student academically, emotionally, and socially. Children with ADHD can be seen by their parents as more vulnerable and in need of more attention than their non-ADHD siblings (Garro & Yarris, 2009).

According to Barkley (1997), ADHD perpetuates problems in individuals establishing goals and planning steps to meet those goals, refusing to attend to distracting stimuli, analyzing and synthesizing new data, and imagining hypothetical outcomes that could result from decisions or weighing the consequences of their actions. The latter relates to the impulsivity characteristic of ADHD, as children with this disorder often choose an immediate stimulus, even if it places them at a long-term disadvantage (Goldstein & Naglieri, 2008). Many researchers have discussed ADHD as a deficiency in application and performance, not a deficiency in skill. These researchers claimed the students are equipped with the knowledge and skill to behave differently, they just do not know how to transfer that knowledge into practice.

Data from a study measuring sensory processing in people with ADHD showed a considerable difficulty in assessing and modulating one's own sensory environment, as well as a higher than normal level of activity (Gutman & Szczepanski, 2005). Parallel data also showed people with ADHD demonstrated greater reactivity in response to stimuli (Dunn & Bennett, 2002). Because of this sensory under-responsivity, students

with ADHD may need additional stimuli in order to help them concentrate. For example, background noise might be needed in order to provide for the optimal level of stimulation to help students with ADHD complete a task (Gutman & Szczepanski, 2005).

Treatment of ADHD

Research studying the effects of verbal and nonverbal strategies used in redirecting the behavior of students with ADHD has shown a combination of behavior management and medication to be an effective intervention for the educational needs of these students (Geng, 2011; Morisoli & McLaughlin, 2004).). Many professionals would agree with this recommendation, although in recent years there has been a significant shift away from medication and an increased focus on behavior management and parent training. Interventions should be individualized based on function and need. Some families have remained skeptical of pharmaceutical interventions and have tried a plethora of options, including changing diets, meditation, herbal therapies, relaxation techniques, and acupuncture (Arnold, 2001).

Regardless of the intervention applied, the available mediations have not been found to normalize functioning and have limited impact on long-term outcomes (Jensen et al., 2007). In addition, pharmacological options have been ineffective in normalizing social functioning or academic performance in children with ADHD (Langberg & Becker, 2012). In fact, medicalization alone as a treatment for ADHD is rarely sufficient to meet the needs of students with ADHD (Brown, 2016). Non-pharmacological options have gained popularity in recent years, as they have been shown to offer therapeutic benefits to both the child and parent that extend beyond the symptoms to be treated (Sonuga-Barke et al., 2006).

Medication as treatment for ADHD

ADHD is a disorder that can be managed but not cured. The difficulties these students face cannot be ameliorated, and symptoms of this disorder often persist into adulthood (Geissler & Lesch, 2011). The medicine that has been developed to treat ADHD consists primarily of stimulants. In the past fifteen years, production of stimulant medication to treat ADHD has increased by 1,700 % (Neufeld & Foy, 2006). These stimulants are essentially tasked with waking up the frontal lobe, the region of the brain responsible for executive functioning (Kutscher, 2005). The dosage for this stimulant medication is not based on age, weight, or severity of the symptoms, but is instead based on how sensitive the individual is to the medication. ADHD, being a heterogeneous disorder, can manifest itself differently in each patient, and individuals will vary in their dosage requirement (Brown, 2016).

A recent study showed elementary students taking medicine to treat ADHD scored higher in math and in reading than their non-medicated peers (NIMH, n.d.). This is significant, considering a study comparing the reading and math scores of students with ADHD to scores of students without the disorder displayed significant deficiencies in students with ADHD (Alvarado, Puente, Jimenez, & Arrebillaga, 2011; Loe & Feldman, 2007).

Neurological studies on regions of the brain have provided insight as to the differences between ADHD and non-ADHD brains. The temporal, frontal, and parietal lobe interconnect to facilitate aspects of attention. In students with ADHD, imaging studies have shown these regions to possess weakened connections (Arnsten, 2009). The cerebellum is often smaller in students with ADHD as well. Stimulants, when applied in

therapeutic doses, reduce locomotor activity and increase activity between these regions in the brain. The results of Arnsten's (2009) study have implications for aiding understanding of attentional difficulties.

According to research conducted in 2005, over 10 million children were treated with stimulant medication for ADHD (Barlow & Durand, 2005), with the most commonly prescribed medications for ADHD being Ritalin, Strattera and Adderral. However, each of these medications came with their own unique set of side effects. Medicating for ADHD has become controversial in recent years due to concerns regarding future drug use, dependency, and side effects, which can include nausea, insomnia, headaches, irritability, loss of appetite, anorexia, emotional lability, and more (Greydanus, 2005). Some studies have shown that as individuals with ADHD age, they discontinue taking their medication. In addition, it has been argued that the longer a stimulant is taken, the less effective it becomes (Science Daily, 2006).

ADHD in schools

When the reason, function, or purpose of a student's behavior can be identified and understood, it can be treated more effectively (Nelson & Williamson, 2004). Studies have indicated many teachers have little understanding of the reasoning behind ADHD behaviors (Ek, Westerlund, Holmberg, & Frenell, 2011). Teachers have long grappled with the best way to meet the needs of students with ADHD. As with most disorders, each student is different and could require a different intervention. ADHD can be viewed as a continuum, with students qualifying in different degrees (Archer, 2015).

Some students respond differently to interventions than others, as students with ADHD are a heterogeneous group (Reiber, & McLaughlin, 2004). This, in itself, presents

a challenge for researchers and schools attempting to meet the needs of students with ADHD in the best way possible. A study conducted in 2011 examined the effects of using verbal and non-verbal strategies with students with ADHD. Although the study showed some of these methods were successful when used with several students, it was also noted these strategies caused the students to attend to a task only momentarily (Geng, 2011). The standard classroom environment in which students are expected to sit still and patiently, raise their hand, wait their turn, and work quietly may not be a conducive learning environment for students with ADHD. This disorder may be manifested by behaviors like squirming, blurting, and impulsivity. According to Irvin (1998), one of a student's central needs is the ability to move in the classroom. Based on OST, it would seem students with ADHD have an even more urgent need for this freedom.

Students with ADHD often do not perform as well academically compared to the other students in their class. When compared to their ADHD peers, non-ADHD students were more likely to choose more challenging math problems and complete them with consistently higher scores (Neef et al., 2005).

Students with ADHD have a significant academic disadvantage. Studies have indicated these students score an average 5-7 points lower than their non-ADHD peers on intelligence tests (Faraone et al., 1993). Although research is limited as to the reasons behind this disparity, one can infer the main symptoms of ADHD (inattention, hyperactivity, and impulsivity) contribute significantly to an academic setting.

Behavior Modification

Several strategies have been found to be effective with behavior modification in the classroom setting (Morisoli & McLaughlin, 2004). Positive reinforcement through

awarding points for on-task and attentive behavior and a daily report card/chart have shown to be effective by providing immediate rewards- something that speaks the language of these students who struggle with impulsivity and crave immediate rewards. In a study by Goldstein & Naglieri (2008), students with ADHD responded well to brief repeated payoffs, rather than a long-term reward. Cognitive behavioral training, also proven to be effective, teaches children to regulate their own behavior. This approach resists the impulsivity of students with ADHD by encouraging self-control. The most effective treatment consists of combining one or more of these behavior modification strategies with medication (Morisoli & McLaughlin, 2004).

Students in the classroom setting could exhibit hyperactive behaviors as a result of tasks that are too difficult or too easy (Zental, 1993). Either way, according to OST, they have not reached the optimal level of stimulation and will continue to seek additional stimulation for easy tasks and to reduce the level of stimulation for difficult tasks. Not only do students with ADHD exhibit behaviors that are not conducive to their own academic performance, but these behaviors can contribute to classroom dysfunction (Barkley, 1997). This is due to their behaviors interfering with their own ability to learn as well as their teachers' ability to teach (Greene et al., 2002; Schlozman & Schlozman, 2000; Sciutto, Terjessen, & Frank, 2000).

Associated movements are unnecessary/excessive movements often displayed by children when engaging in a new motor task. These movements reduce biomechanical efficiency and increase the amount of energy expended toward these movements (Licari, Larkin, & Miyahara, 2006). Research linked children with movement disorders with more associated movements than children without (Licari & Larkin, 2008). Many

researchers associate ADHD with movement disorders, and believe hyperactivity can often be manifested in these children through associated movements, even though motor deficiencies are not usually characteristic of a child with ADHD unless another disability is present (Martin, Piek, Baynam, Levy, & Hay, 2010).

Teacher training concerning ADHD

ADHD diagnosis involves analyzing the behaviors of two prominent environments: school and home. Teachers and parents alike interact with students with ADHD on a daily basis. Although there is a multitude of information regarding ADHD available in current literature, there is a significant gap regarding teacher knowledge of strategies to implement in regard to students with ADHD. Schools are not well-prepared to meet the needs of students with ADHD (Ek, Westerlund, Holmberg, & Frenell, 2011). Eighty-nine percent of elementary school teachers claimed they received no instruction regarding students with ADHD during their college programs and 92% reported receiving only a little training after graduation (Jerome, Gordon, & Hustler, 1994). With such a large group of students being diagnosed with and showing symptoms of this disorder, this lack of teacher preparation to meet the needs of these students is an oversight needing immediate attention. Although research has aided public knowledge about ADHD, there remains a significant gap between knowledge and practice in school settings (DuPaul & Stoner, 2014).

One study investigating the experience of mothers and teachers interacting with these students found these caregivers shared the burden of caring for these students, inadequate support and resources, disturbances of the child's behavior, and a lack of understanding (Harazni & Alkaissi, 2016). Due to the increased diagnosis of students

with ADHD, Mulligan (2001) called for an increased awareness among therapists of ways to manage classroom behaviors of these students. She also recommended an increase in strategies to be implemented to help these students experience academic success.

Because of the behavioral, social, and academic difficulties encountered by students with ADHD, teachers should be prepared to meet their needs in the classroom in order to combat the adverse effects these students may experience throughout their lifetime. A recent study conducted with middle school teachers showed an understanding of the symptoms of ADHD, but a lack of knowledge regarding the cause, nature, and treatment of ADHD (Guerra & Brown, 2012; Topkin, Roman, & Mwaba, 2015). In order to assess teacher knowledge, experience, and outlook on ADHD, a researcher gave teachers a survey; the results showed "only five out of thirteen items were answered correctly by more than half of the responding teachers" (Snider, Busch, & Arrowood, 2003).

A study was completed incorporating a 12-week professional development training of behavior management and classroom-specific strategies to be used with students with ADHD. The results of this study showed significant treatment of the disorder when elements of the trainings were implemented in classroom settings (Froelich, Breuer, Manfred, & Amonn, 2012). Teacher knowledge and attitudes affect their classroom practices, which in turn affect their students. Teachers cannot implement strategies they are not aware of. Because of the disruptive nature of the symptoms of ADHD, teachers could develop a negative view of students with ADHD; this could

possibly stem from that fact that students with ADHD tend to exhibit behaviors that are not conducive to the standard classroom environment (Froelich et al., 2012).

Teachers were more likely to implement behavior management strategies when they realized they were appropriate for whole-class use and positive reinforcement could be used (Froelich et al., 2012). Teachers who had students with ADHD in their classrooms might have had specific training on how to teach students with this disorder, but the majority has not (Robuck, n.d.). Many teachers have been left to determine on their own how to best address the needs of these individuals and have been left feeling frustrated and inept.

When teachers were provided with professional development training regarding teaching students with ADHD, the results were positive (Zentall & Javorsky, 2007). Teachers who were trained according to the optimal stimulation theory used techniques to provide and keep an optimal stimulation level by using more colorful bulletin boards, short transition times, and choral responses- all techniques targeted for students with hyperactivity. These trained teachers also showed increased empathy for students and willingness to accommodate (Zentall & Javorsky, 2007). Providing teachers with information to explain behaviors and strategies to modify those behaviors can result in changes in the classroom.

Movement and learning

Neurological Implications

Exercise provides a plethora of healthy benefits. Physical movement stimulates the release of nutrients, hormones, and cleansing agents that supply the brain with exactly

what it needs when it needs it. It can also promote cognitive function and mental focus (Hallowell & Ratey, 2005).

Movement integrated with learning has shown to be an effective strategy in the classroom. The most basic scientific principles regarding the brain point to the benefits of exercise in brain development. Enhanced blood flow increases the amount of oxygen transported to the brain, and oxygen is essential to brain functioning. Physical exercise is a good way to increase the amount of blood flow, and therefore good for the brain. The part of the brain that processes movement, the cerebellum, is the same part of the brain that processes learning (Middleton & Strick, 2001).

Researchers have conducted studies in order to further explore the roles of different parts of the brain. One study recently made the discovery brains can actually grow new cells (Kempermann, Kuhn, & Gage, 1998). In fact, some activities inhibit growth of new cells while other activities stimulate growth. One of these stimulant activities is exercise. Studies show students need between 30 and 60 minutes of exercise each day (Center for Disease Control, 2015). Physical exercise can actually alter brain structure. According to research, students who exercise on a regular basis boast a larger hippocampus, the area of the brain linked to memory and learning (Gnaulati, 2016).

Researchers conducted a study group in order to discover middle school students' perspectives of their lives during this transitional time period. Students reported a desire for more hands-on activities in the classroom, as well as an overall desire for classrooms to be active (Steinberg & McCray, 2012). Results of studies done on both humans and animals showed 30 minutes of vigorous exercise three times a week make a significant

contribution to increased brain mass, increased amount of brain cells, superior cognition, better circulation, and even a better mood (Van Praag, Kempermann, Gage, 1999).

Physical education through play has been shown to stimulate frontal lobe maturation and promote prosocial minds in children. This also contributes to the alleviation of ADHD symptoms (Panksepp, 2007). Exercise has shown to enhance the ability of animals to learn and remember (Vanynman, Shoshanna, Ying, & Gomez-Pinilla, 2004). Studies show elderly humans have also used physical exercise to delay and prevent cognitive decline (Kramer, Colcombe, Bherer, Dong, & Greenough, 2004). Mages (2006) argued using voices and bodies simultaneously can also significantly enhance learning and memory.

Physical Education

According to research, 64% of K-12 American students do not participate in a daily physical education program (Brink, 1995). Schools in the past have cut physical education programs in order to dedicate more time to academics, yet evidence shows exercise is a crucial part of student learning (Pollatschek and O'Hagan 1989; Ratey, 2008; Reilly, Buskist, & Gross, 2012). One study which focused on children's brain size noticed a 20% deficiency in children who did not exercise through play as opposed to children who did (Nash, 1997). Exercise has been linked to improved classroom behavior and academic performance in students (Dwyer, Sallis, Blizzard, Lazarus, & Dean, 2001).

While many schools offer physical education programs, students can benefit by participating in structured as well as choice movements in the classroom. Steven L. Layne (2009), author of *Igniting a Passion for Reading*, says, "Environment matters and that the opportunity for kids to get up from desks is important" (p. 102). In the opinion of

an endocrinologist at the Mayo Clinic, a person who has been seated for an hour has been seated too long (Honan, 2014). However, many students in our public schools are asked to sit for several hours as they learn according to a traditional learning style (Brink, 1995).

When students are engaged in physical fitness, their reading scores are likely to improve (Castelli, Hillman, Buck, & Erwin, 2007). Carla Hannaford (2007), neuropsychologist, educator, and author of *Smart Moves,* observed the scores of 500 Canadian students. She found that those who spent one extra hour in physical education class each day outperformed their classmates who were not given this hour. A school in Pennsylvania adopted a physical education program focusing on helping students adopt a physical exercise routine they could continue for life called "PE4life" (PE4Llife, 2007). Once this program was implemented, the school's scores went from below the state's average to 17% above average in math and reading. At Woodland Elementary School in Missouri, after incorporating daily physical education for one year, suspension rates dropped by 67%, and fitness measures and literacy improved (Ratey, 2008). Recess plays an important part in the school day. Students who engaged in play at recess showed less fidgeting and fewer incidents of misbehavior than students who did not engage at recess (Pelligrini & Davis, 1993).

The state of Tennessee recently released a state mandate requiring each local education agency to provide students with 90 minutes of physical activity each week (Opportunities for Physical Activity, 2015). For students in grades two through six, two 20-minute periods of non-structured physical activity are required to be provided at least

four days a week. According to the research cited, this mandate will provide movement that will benefit these students academically.

Movement in the Classroom

A researcher interested in the effect of active learning conducted an informal study in which she facilitated five active lessons and five inactive lessons. The data collected showed the students were more engaged and more motivated during the active lessons (Swann, 2000). Students who interacted with academic content through movement found themselves motivated to listen to instruction to keep from missing out on pertinent information regarding the nature of the activity (Jensen, 2005) This heightened state, also referred to in psychology as "arousal," can easily be achieved by incorporating physical movements into classroom activities (Marzano & Pickering, 2010). Research has demonstrated simple stretches or even play time can be effective in heightening student's energy levels and motivating students to engage (Marzano & Pickering, 2010). Movement provides a type of engagement that is necessary for motivation and attention and induces learning through increased sensory awareness (Hannaford, 2007; Corbin, 2008).

One study found that a 12-minute aerobic exercise session could improve the selective attention of children. This study focused on the difference between the effect of aerobic exercise on low-income and high-income children. The results showed improvements in children from both socioeconomic statuses, but found a greater improvement in children from low-income families. This data proved valuable as the achievement gaps between low-income and high-income children continued to widen (Tine & Butler, 2012).

Caterino & Polak (1999) conducted a study in which a classroom was divided into two groups. The control group was assigned an academic-learning environment. The experimental group was assigned the gym environment. Both groups took the same achievement test, with the control group heading straight to the classroom to take the test. The experimental group headed to the gym to stretch and exercise. After 15 minutes of exercise, they joined the control group and took the test. The results showed the experimental group out-performed the control group. The researchers concluded students who engage in physical activity could significantly improve mental focus and concentration levels (Caterino & Polak, 1999).

Terrence Dwyer (1983) conducted multiple studies suggesting the benefits of exercise in school. One part of his research consisted of an experimental group getting four times more exercise each week than the control group. The experimental group suffered no loss in academic scores despite their "loss" of academic study time (Dwyer, Coonan, Leitch, Hetzel, & Baghurst, 1983). Other research showed students who exercised regularly experienced greater academic performance and a better attitude toward school than their peers who did not exercise regularly (Donevan & Andrew, 1986).

A study by Hillman and colleagues compared student performance on a cognitive task. Students participated in completing a cognitive task after walking on the treadmill for 20 minutes, and their results were compared to students who remained seated prior to completing the task. The outcome showed data positively linking physical activity, attention, and academic achievement (Hillman et al., 2009). After reviewing the relationship between academic outcomes and physical activity, one researcher determined

time spent away from academic classroom times was adequately compensated through the short-term cognitive benefits of physical activity (Taras, 2005).

Texas Assessment of Knowledge and Skills (TAKS) is a standardized test producing academic achievement scores for Texan students. The Cooper Institute compared these scores to fitness scores from Fitnessgram in the 2009 Texas Youth Fitness Study and discovered several significant correlations between physical fitness and academic achievement indicators, including the relationship between higher levels of fitness and better academic performance, increased school attendance, and fewer negative incidents at school. Results from a study done by the American Academy of Pediatrics involving first-and-second-graders indicated exercise and intentional movement can be linked to improved test scores. The students moved through learning labs and participated in activities such as walking on ladders while naming the colors on each rung and tracing shapes on the ground while seated on scooters. These action-based learning labs focused on guiding students through learning developmentally appropriate movement skills while practicing grade appropriate academic skills (Mitchell, 2012).

Boswell and Mentzer (1995) conducted a study during which they tested movement integration with poetry in students with ADHD. They observed the following benefits: positive social interaction with peers while participating in the program, release of excess energy and tension through movement activities, and growth in movement expression, reading, and vocabulary. Incorporating movement into fluency instruction increases student motivation as well as the brain's plasticity and capacity to learn (Peebles, 2007).

After reviewing the research, one professor created a program, Smart Start, in

order to develop higher levels of academic success by stimulating children's sensory motor systems. Some of the results reported among children were better attention levels, higher reading scores, improved literacy skills, and better-developed listening skills (Palmer, 2003). One of the ways movement benefits the brain is through amines. Amines are one of the brain's primary fuels for the attentional system (Purves, Augustine, & Fitzpatrick, 2001). Amine levels can be raised by movement (Jensen, 2005). Research shows eliciting a state of aroused attention using amines can be accomplished simply by taking a walk (Saklofske & Kelly, 1992). Other activities responsible for raising amines include those activities including change, excitement, movement, and a small learning risk. Research shows taking physical activity breaks throughout the day lead to improved student behavior and learning (Reilly, Buskist, & Gross, 2012).

A study in four elementary Seattle Public School focused on 250 students who studied language arts through movement and dance over the span of twenty weeks. These Seattle third graders showed a 13% increase on their statewide-standardized test. The results showed a direct relationship between the percentage increase of student's scores and the amount of movement the classroom teacher incorporated into her language arts curriculum (Gilbert, 1997). Recent research investigating the effect of movement in the classroom has produced concurrent results. Studies demonstrated that the use of therapy balls in classrooms is leading to increased focus and improved learning (Bagatell, Mirigliani, Patterson, Reyes, & Test, 2010; Schilling and Schwartz, 2004; Schilling, Washington, Billingsley, & Deitz, 2003). Studies demonstrated that after substituting therapy balls for standard chairs, there was general improvement in on-task behaviors (Capell, 2012; Haan, 2015).

One researcher claimed the frequency of the movement was in direct relation to the resulting academic achievement: higher amounts of movement lead to higher amounts of achievement (Shoval, 2011). Shoval (2011) described four movement-based learning activities teachers can adapt to fit the needs of their classroom:

- Physical contact with the environment being studied,
- Visual and Kinesthetic Modeling,
- Verbal and socio-kinesthetic interaction,
- Sustained movement-aided learning activity.

He described movement as an exterior stimulus, and explained the exterior action is difficult to sustain when the attention is purely interior. When the attention was purely interior, it resulted in inactive nerve and muscle systems (Shoval, 2011). The passive learner was more likely to allow his or her mind to wander and ignore the learning process. Incorporating movement activities essentially forced the passive learner to consciously engage with the learning at hand, instantly becoming an active and engaged learner.

Several schools in Canada, noticing a reduction in the amount of exercise provided for children, began installing treadmills and other exercise equipment to be used in the classroom. The purpose of this equipment was not only for exercise; it was to help students focus (Treadmills put New Brunswick students on learning track, 2011).

Movement and Students with ADHD

Movement as a Stimulant

According to Hallowell & Ratey (2005), ten minutes of exercise offered the same benefits as a dose of Ritalin, a common stimulant prescribed to students with ADHD.

Physical activity has been shown to have a calming effect on students with ADHD (Jensen & Kenny, 2004). This research supported the OST in that physical activity was providing the stimulation these students were seeking.

The predominant theory on ADHD recommends stimulants as the prescribed treatment, based on the belief the disorder is caused by underarousal of the brain. Based on this theory, applying other methods of stimulation, such as physical movement and activity, could be beneficial to students diagnosed with ADHD by reducing the exhibition of symptoms (Sarver, Rapport, Kofler, Raiker, & Friedman, 2015).

In a recent study recording movement in students with ADHD, students with ADHD were significantly more active than typical students and exhibited significantly higher intensity movements (Sarver et al., 2015). Research calls for an integration of devices into the classroom that can accommodate movement without being disruptive, such as exercise balls or stationary bikes (Sarver et al., 2015). Students diagnosed with ADHD who struggle to focus and sit still could benefit from an alternative way of learning in order to reach their potential. Much of the inattentive behavior exhibited is believed by researchers to be due to the need for movement (Robinson, 2010; Strauss, 2014). Several researchers suggested that teachers of students with ADHD provide these students with the ability to move and to expend pent-up energy, further supporting the idea that movement could serve to alleviate some of these behaviors (Reiber & McLaughlin, 2004).

There is a clear relationship between movement and learning. Recent research has shown a relationship between movement integrated into learning and the resulting effects in children with ADHD. Researchers at the University of Central Florida conducted a

study in which 8-12 year old boys were given a task involving letters and numbers designed to test their working memory. Out of the 52 boys, 29 were diagnosed with ADHD and were allowed to move around in a spinning chair while testing. The results of the study showed the ability to move around while testing was beneficial to the boys with ADHD (Sarver, Rapport, Kofler, Raiker, & Friedman, 2015).

Motor Movements in Students with ADHD

Some studies have linked students with ADHD with developmental delays in movement skill performance and motor coordination when compared to their peers (Harvey et al., 2007). It is hypothesized this could actually be a consequence of their social interactions; fundamental motor skills are often developed through social play with other children, and children with ADHD, who often experience social difficulties, could be experiencing a developmental delay in this area due to the social impact of their disorder (Pan, Tsai, & Chu, 2009). Indeed, related research showed poor motor performance was highly related to low self-esteem, to higher levels of anxiety and to poor social functioning (Cummins et al., 2005).

Researchers hypothesized students with ADHD would perform at a lower level on a physical fitness test when compared to their peers, citing previous studies finding deficiency in motor movements (Verret, Gardiner, & Beliveau, 2010). However, the students with ADHD performed at the same level of their peers, even in a shuttle run, which required hand-eye coordination and multi-tasking. Researchers concluded these students could indeed focus on this task and perform physical activities on par with their peers. In fact, at the end of the study, it was concluded that students with ADHD could

even perform at a higher level than their peers due to hyperactivity (Colombo-Dougovito, 2013).

According to Laver-Bradbury (2011), students with ADHD can benefit from active learning in the classroom. Several researchers believe the use of play can actually alleviate the symptoms of ADHD as well as reduce the need for medication. (Panksepp, 2008). According to Panksepp (2008), inadequate opportunities for play during crucial developmental years have led to an increased incidence of ADHD. A study focusing on the relationship between recess and ADHD-related behaviors showed levels of inappropriate behavior were significantly higher on days the subjects did not have recess as compared to days they did have recess (Ridgway, Northup, Peilegrin, LaRue, & Hightsoe, 2003). In addition, providing regular, noncontingent exercise for students with ADHD showed a decrease in classroom disruptions (Allison, Faith, & Franklin, 1995).

Kinesthetic Learning

Because students learn in different ways, there is more than one approach to teaching. Gardner's (1983) theory that different types of minds necessitate different types of learning styles included seven different types, one of which was bodily-kinesthetic. A student who prefers the bodily-kinesthetic learning style enjoys learning with the whole body involved through physical activity, hands-on movements, gestures, and role-playing. Some recent researchers have proposed students with ADHD could be bodily-kinesthetic learners who are suffering from a movement-deficit in stagnant classrooms (Gray, 2009). According to Hannaford (2007), roughly eighty-five percent of students are natural kinesthetic learners.

Therapy Balls Linked to Attention

Movement can be linked to increased academic focus in children at-risk for ADHD. A study following the effects of before-school physical activity showed reductions in incidents involving inattention in students at risk for ADHD (Hoza et al., 2015). Researchers studying the effects of implementing therapy balls in place of standard chairs in an elementary classroom reported a higher number of observed incidents of on-task behavior when students were seated on the therapy balls than when they were seated in standard chairs (Burgoyne & Ketcham, 2015). Their study also showed an increased frequency of movement when students were seated on therapy balls, leading them to correlate the use of therapy balls to the engagement of the vestibular system.

A related study demonstrated therapy ball usage in connection with enhanced attentional ability in students with ADHD (Wu et al., 2012). Students with ADHD and students without were asked to sit alternatingly in standard classroom chairs and exercise balls while responding to an oddball auditory task. When seated in the standard classroom chairs, students without ADHD had a faster response rate than students with ADHD. This is unsurprising, given that students with ADHD typically show a slower processing and reaction time than students without ADHD. However, this reaction time in students with ADHD was decreased further when they were seated on exercise balls. Thus, the results of this study showed providing students with ADHD this change in learning environment had a positive effect on their ability to focus.

A similar study was conducted in a fourth grade classroom. Students with ADHD were observed when seated on standard classroom chairs as well as when seated on

exercise balls. Researchers noted an increase in on-task and in-seat behavior when students were using the exercise balls (Schilling, 2003). A study seeking to find effective strategies in managing the behavior of students with ADHD surveyed general education teachers regarding their classroom practices. One of the strategies rated as the most highly effective was the use of motor breaks. Teachers involved in this study suggested the use of more hands-on activities in order to further advance the learning of students with ADHD (Mulligan, 2001).

Need for the Study

The above review of literature demonstrates a clear academic, social, and emotional deficit concerning students with ADHD as well as a significant correlation between movement and learning. The research concerning ADHD, however, is lacking in regard to incorporating movement into the classroom in order to address this academic deficit. The review reveals a gap in the area of research regarding movement serving as stimulation to students with ADHD in order to direct focus to academic tasks. Although several studies have been completed regarding the use of exercise balls with students with ADHD, little research has been done to account for both structured and unstructured movements. Additional research is needed in order to bridge this gap and provide data regarding the relationship between movement and attention in students with ADHD.

CHAPTER 3

Methodology

The purpose of this study was to discover the relationship between movements in the classroom and amount of ADHD-related behaviors in students diagnosed with ADHD. This study sought to answer the following questions:

1. What is the relationship between movement and the amount of exhibited ADHD-related behaviors in students diagnosed with ADHD?

2. What is the variation in the hyperactive behavior of students with ADHD when structured versus unstructured movements are incorporated?

The researcher sought to answer these questions through observing the number of ADHD-related behaviors manifested in the classroom environment, with and without integrated movements, as well as through observing the number of behaviors in relation to structured versus unstructured movements. This chapter describes the research design, research methods, population and sample, and the procedures and instruments used to collect data.

Population and Sample

The population of this study consisted of sixth grade students diagnosed with ADHD attending an East Tennessee middle school. This East Tennessee middle school was made up of 1,441 students in grades sixth, seventh, and eighth. A purposive sample of four sixth-grade students diagnosed with ADHD, two girls and two boys, was used in this study. Purposive sampling is used when subjects are judged to be representative of the population and the sample is selected based on their characteristics and the objective of the study (Ary, 2010). These students were selected for the sample of this study due to

their primarily hyperactive manifestation of ADHD. The ADHD-related behaviors cannot be manipulated; therefore, the researcher selected this sample instead of taking a random sample. The researcher did not randomly apply treatment in this study as the treatment of movements was applied to each of the participants in the study.

These students were enrolled in the inclusion section of the sixth grade ELA class. Inclusion refers to the act of students with disabilities being incorporated into a standard classroom. These four students with ADHD also had an Individualized Education Plan (IEP) along with their ADHD diagnosis. Informed consent was obtained from parents prior to participation in the study. IRB approval was received from Carson-Newman University.

Research Method and Design

Quantitative research methods were used in this study in order to determine the impact of movement on the number of off-task behaviors in students with ADHD. The factors examined in this study included the attentional ability of students with ADHD without any treatment, with the treatment of structured movement such as the use of brain breaks and teacher-directed movements, and with the treatment of unstructured movements such as movements involving exercise balls and bouncy bands.

The researcher sought to discover the relationship between movement as a treatment, the independent variable, on the number of ADHD-related behaviors exhibited by students with ADHD, the dependent variable. The design for this study was a single-subject experimental design, in which the sample size consisted of four participants who are treated as one unit (Ary et al., 2014). Single-case designs have been useful when the focus of the study is the therapeutic value of an intervention for the participant (Ary et al.,

2014). In this particular study, the focus was to discover the value of movement as an intervention to be implemented with students with ADHD. Because ADHD is a heterogeneous disorder, it can manifest itself differently in each individual. Due to this stratification, four students with similar manifestations of ADHD, primarily hyperactivity, were selected for this study and functioned as the single-subject.

Specifically, a multiple-baseline across-participants design was implemented, in which the same intervention was applied to similar behaviors of different individuals in the same setting (Ary et al., 2014). The treatment applied was the same across all individuals. The baseline period consisted of the period of time during which the treatment of movement was not present. The baseline period in this study was the time in which the researcher observed the students in their natural classroom environment and recorded the number of ADHD-related behaviors. These data served as control group data and are recorded in the *Phase I Baseline Table*. The treatment period in this study was twofold: treatment period A was the time during which unstructured movements were implemented with the students, and treatment period B was the time during which the structured movements were implemented with the students. The researcher observed the students during treatment period A and collected data on the ADHD-related behaviors exhibited in *Phase II Treatment Table*, and then observed students during treatment period B and collected data on the ADHD-related behaviors exhibited in *Phase III Treatment Table.*

Data Collection

Instrumentation

The tools for data collection used in this study were the observational logs entitled *Phase I Baseline Table, Phase II Treatment Table, and Phase III Treatment Table*. These tables were developed based on the symptoms of ADHD provided in the DSM-V (American Psychiatric Association, 2013), as well as planned types of movements to be incorporated in the classroom. The data collected was quantitative in nature, as the researcher used the tables to record the number of off-task behaviors students with ADHD exhibited during 10-minute intervals in a 60-minute class period. The observation took place during the first class period of the day for each observation for a total of three days, maintaining consistency in the time of day. The tables were formatted similarly in order to provide for comparable data.

Procedures

This study took place over the course of two weeks and data was collected over the course of three days during those two weeks. The participants and the researcher did not interact over the course of the following observations, and the participants' behavior was recorded in the tables regardless of the nature of the classwork being completed during observation. Once approval was attained from the IRB board, the researcher observed participants in a natural classroom environment and recorded the number of ADHD-related behaviors in 10-minute intervals for a 60-minute class period on the Phase I Baseline Table. One tally was equivalent to one occurrence of the behavior. One occurrence of the hyperactive/inattentive behavior was equivalent to a duration of five seconds.

Once this baseline was established, the next phase of observations began. Participants were provided with exercise balls as alternatives to a standard desk chair or with bouncy bands for their feet. The researcher then observed the unstructured movements in which the students engaged for 10-minute increments during a 60-minute class period and the ADHD-related behaviors exhibited during this time. This data was collected in the Phase II Treatment Table.

Once this data collection period ended, structured movements were incorporated into the next observed 60-minute class period in 10-minute intervals. The researcher observed the participants and recorded ADHD-related behaviors in 10-minute increments as well as the type of structured movement incorporated. This data was recorded in the Phase III Treatment Table.

Data Analysis

Once the data for all three phases of collection reached saturation, the researcher analyzed the data in order to determine the correlation between the treatment applied and the dependent variable. The researcher first organized the observed number of behaviors in a frequency distribution according to each treatment period. The statistical tests used in this study include MANOVA, a multivariate analysis of variance that tests for the difference in two or more vectors of means (Ary et al., 2014).

In order to succinctly analyze the data, the researcher exported the data into SAS JMP software. This software provided a visual break down of the data in order to interact with the data in multiple views, rank the significance of variables, monitor the effect of changing factors, and examine the interaction among all factors. SAS JMP provides an opportunity for the researcher to view disaggregated data for each variable. The statistical

test of multivariate analysis of variance (MANOVA) was used to determine the interaction between variables.

Threats to Internal Validity

It is possible the researcher unintentionally interfered with the results through observer bias. Because the researcher hypothesized behaviors would decrease, it is possible fewer behaviors were recorded regardless of the number of behaviors displayed. It is also possible that being in a classroom setting with middle school students created an observer effect with the participants. Because the students knew they were being observed, they may have acted differently.

One of the subjects at the time of the experiment was also completing a behavior contract. This behavior contract awarded her with a certain amount of points if she met the criteria. One of the criteria was, “Not interrupting the teacher.” Because she had additional incentive to avoid this behavior, the researcher predicted this student would exhibit fewer occasions of this ADHD-related behavior.

CHAPTER FOUR

Results of the Data Analysis

This study was developed to determine if unstructured and structured movements implemented as an intervention would be effective in reducing the number of ADHD-related behaviors. The researcher hypothesized if students are provided with stimulation through activities providing for movement, the stimulus-seeking behaviors will decrease. Data were analyzed using MANOVA which tests for the combined effect of two or more independent variables (Ary et al., 2014).

Averages Between Treatments

The average number of ADHD-related behaviors manifested by each student during each 60-minute class period, according to each observation period, is recorded in Table 4.1. On average, Student J exhibited twice the level of hyperactivity as Student S, and almost three times the level of hyperactivity as the other two students. Table 4.1 shows each student on average manifested fewer ADHD-related behaviors during the unstructured time period than during the baseline time period. Student J showed the largest decrease in manifested behaviors during the unstructured time period as compared with his peers. Table 4.1 also shows the average amount of ADHD-related behaviors manifested increased between the unstructured observation and the structured observation for three of the four subjects. Students C, S, and Z, did not seem to respond as well to the structured treatment as to the unstructured treatment. However, the amount of ADHD-related behaviors manifested by Student J continued to decrease between the unstructured and structured observation periods. Student J began with an average of 71 ADHD-related behaviors per class period, produced an average of 45.5 of these behaviors during the

unstructured treatment, and an average of 21.66 behaviors during the structured time period.

Table 4.1
Average Amount of ADHD Behaviors Per Period

Student	Baseline	Unstructured	Structured
Student C	21.33	3.16	31.66
Student J	71	45.5	21.66
Student S	29.8	6	22.8
Student Z	10.83	4.83	10.16

Sum of Behaviors

The overall sums of the ADHD-related movements displayed for each student in each observation period are shown in Table 4.2 and displayed graphically in Figure 4.3. Because ADHD is a heterogeneous disorder, it typically manifests differently according to each individual. The "Baseline" column in Table 4.2 displays just how differently the disorder is manifested in each subject. Student J was a prime example of this phenomenon, as his baseline count for ADHD-related behaviors began at 426 behaviors manifested in a 60-minute time period. The average number of ADHD-related behaviors exhibited by Student C, S, and Z during the unstructured treatment period was 33. The average number of ADHD-related behaviors exhibited by Student J was 273. Although Student J showed remarkable improvement between the baseline and unstructured period, his level of hyperactive behavior was eight times that of his peers.

The last row of Table 4.2 illustrates the total number of ADHD-related behaviors exhibited during each daily observation period. The number of ADHD-related behaviors exhibited by students decreased by 53.77 percent in between the baseline period and the unstructured treatment. A decrease of 39 percent was found between the baseline period and the structured period.

Table 4.2
Sum of ADHD Behaviors for Each Student

Student	Baseline	Unstructured	Structured
Student C	128	19	187
Student J	426	273	130
Student S	188	52	114
Student Z	65	29	61
Total	807	373	492

Figure 4.3 displays the sum of the ADHD-related behaviors displayed in each period, as opposed to the means, and graphically illustrates the effect of both the unstructured and structured treatment. These data show a noteworthy dip in ADHD-related behaviors manifested during the unstructured time period for three of the four students. When viewing the graph, the amount of ADHD-related behaviors manifested during the structured time period do not seem to be much different than the amount manifested during the baseline for three out of the four students. However, the fourth student, Student J, showed the greatest decrease in these behaviors during the structured period, as the number of behaviors exhibited dropped from 426 to 130. This 69 percent decrease in ADHD-related behaviors could indicate the use of structured movements as an effective intervention strategy.

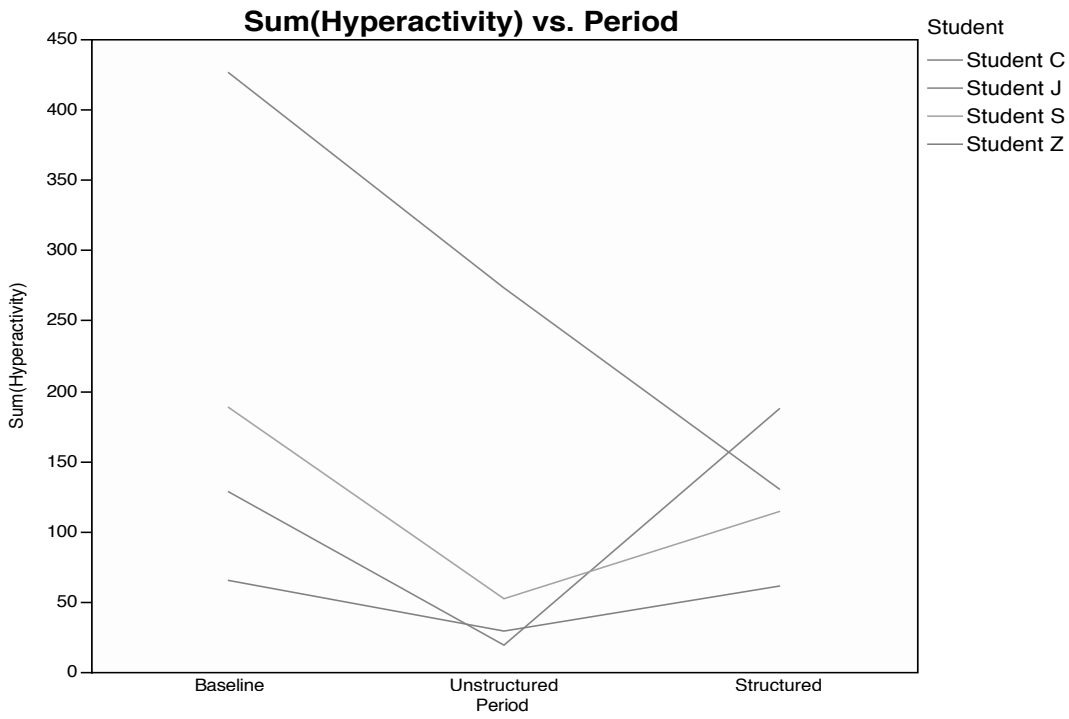

Figure 4.3
Sum of Hyperactivity in Each Period

Variation Between Students, Treatments, and Time Periods

Figure 4.4 reveals the variation of ADHD-related behavior exhibited between students, the variation between treatments, and the variation within the time periods. Student J displayed the greatest variation during each time period, with counts of hyperactive behaviors spiking from 46 to 97 in one period. Student Z displayed little variation during the baseline and unstructured periods, but a greater variation during the structured period. Interestingly enough, although no statistical significance was found when the structured movements as a treatment were considered, the distribution of variation during the structured period appeared less than the previous two distributions. The grouping of data points of the three students (C, S, and Z) for both the baseline

period and structured period is very similar in range. The number of ADHD-related behaviors exhibited during the baseline period ranges between a high of 188 and a low of 65 and during the structured period, a high of 187 and a low of 61. Similarly, the means of these three students were virtually identical with an average of 127 behaviors exhibited during the baseline period, and an average of 121 behaviors during the structured period. The variability between students was especially evident during the baseline observation period. The variation within time period, as well as the average number of ADHD-related behaviors, appeared to decrease for Student J across the periods (See Figure 4.4).

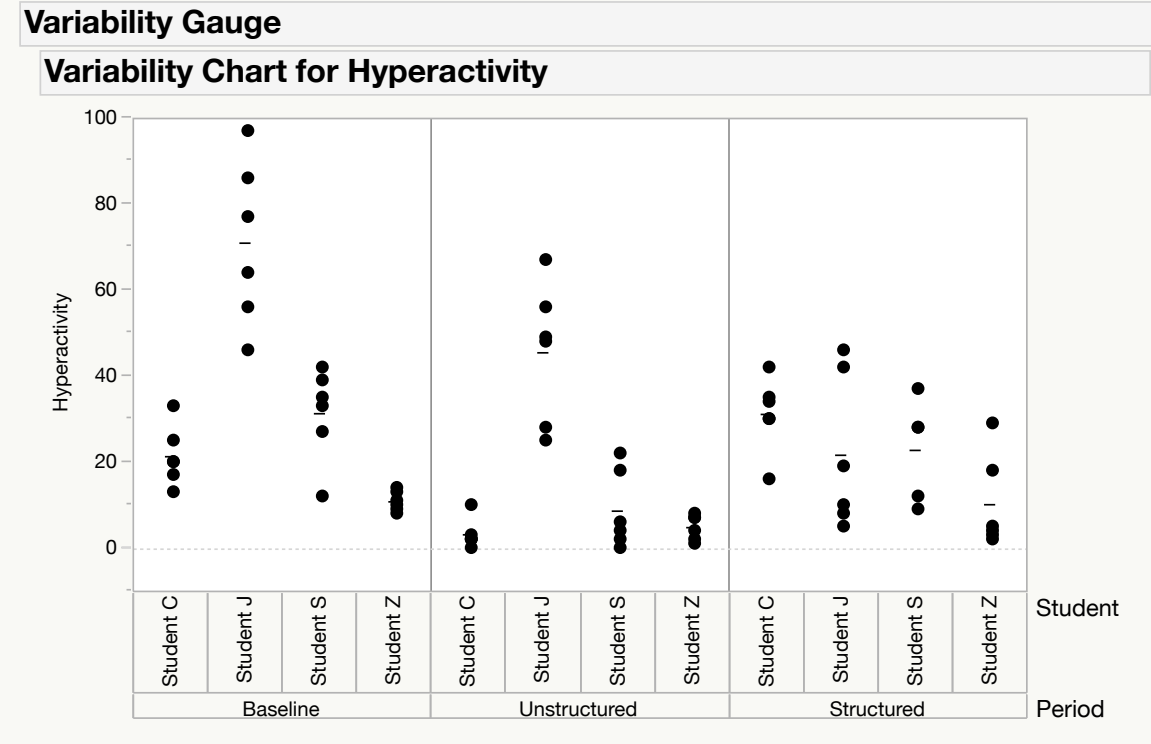

Figure 4.4
Variability Chart for Hyperactivity
The coordinates in this chart represent each hyperactive behavior exhibited during each observation period.

ADHD-Related Behaviors Across Observations

The researcher investigated at the average number of ADHD-related behaviors

manifested across three observation periods for all four subjects in order to determine statistical significance. Epsilon is a measure of the degree that the covariance matrix departs from compound symmetry. The further the Greenhouse-Geisser (G-G) Epsilon estimate varies from 1, the more the sphericity assumption is violated. A standard procedure is if G-G Epsilon is greater than .75, use the adjusted G-G univariate F-test. If G-G Epsilon is less than .75, use the multivariate F-test (Sanders, 2016). Because a G-G Epsilon of .57 was found, which is less than .75, the test that best fit this data set was a multivariate test. No statistical significance was found between periods across the three observation periods when all four subjects were included as shown by a p-value of .1209 using the test for MANOVA (See Table 4.5).

Table 4.5
Test for MANOVA

Period

Test	Value	Exact F	NumDF	DenDF	Prob>F
F Test	7.2725368	7.2725	2	2	0.1209
Univar unadj Epsilon=	1	1.7438	2	6	0.2529
Univar G-G Epsilon=	0.5717191	1.7438	1.1434	3.4303	0.2752
Univar H-F Epsilon=	0.6931503	1.7438	1.3863	4.1589	0.2691

Due to the extreme number of ADHD-related behaviors exhibited per period as compared to his peers, the researcher also tested the data set with Student J removed. Once Student J was removed from the data set, the G-G Epsilon was shown to be above .75, which suggested a univariate test as the best fit for this data set. This test produced p-values close to 1 at .4.

Correlation Between Ball and Band

Each subject reacted slightly differently to the two treatments. Because the unstructured treatment seemed to have the greatest effect on the number of exhibited behaviors, the researcher studied the correlation between ADHD-related behavior and

each part of the unstructured movement treatment, the therapy ball and the bouncy band. A negative correlation coefficient was produced for the relationship between ADHD-related behavior and the therapy balls and bouncy band for Student C and Z. Student J showed a correlation of .8057 and Student S showed a correlation of .0344. These correlation coefficients indicated a positive association between ADHD-related behaviors and the amount of engagement with the therapy ball and bouncy band. This could suggest that students were channeling their ADHD-related tendencies into other forms of stimulation, such as kicking a band with their feet or engaging in a continuous swaying or rocking movement while seated on a therapy ball.

The researcher also conducted a paired t-test with the data in order to test the mean difference between baseline observations and the unstructured treatment. With a confidence level of 95%, there is statistical significance at the .05 level with a p-value of .0246. However, when Student J was removed, the paired t-test shows a p-value of .08. This demonstrated the magnitude of the impact that Student J had on this data set.

Variation Within Period

The number of ADHD-related behaviors recorded for each student illustrated an interesting pattern in terms of variation within the period. At the end of the unstructured treatment, during the last 20 minutes of the 60-minute time period (9:10 - 9:30) the students appeared to regress when compared with the initial 40 minutes of the period. Although it is clear from viewing the data there was an impact when the unstructured treatment was applied, it almost seems as if the treatment becomes less effective near the end of the period. For students C, S, and Z, the greatest decrease in ADHD-related behaviors was displayed during the first 40 minutes. For Student J, the greatest decrease

was displayed within the first 30 minutes (see Figure 4.6

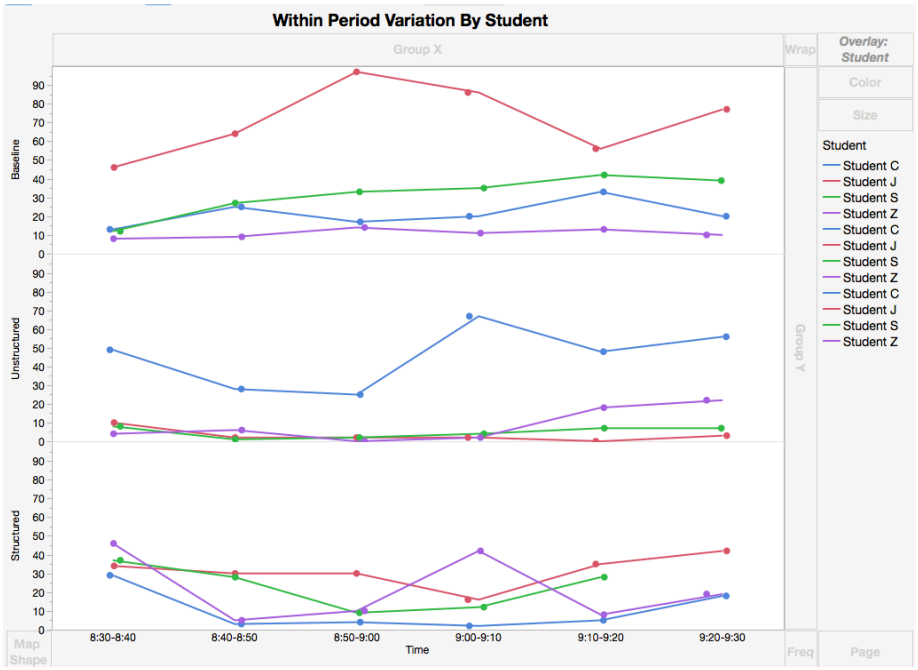

Figure 4.6
Within Period Variation By Student

CHAPTER FIVE
Discussion

Chapter Five provides a discussion in response to the data presented in Chapter Four in order to expound on the findings and explore the implications of the results. This chapter is divided into three main sections for clarity. The first section addresses the response to the research questions posed in Chapter One. The second section discusses the implications for classroom practices, and the third section provides recommendations for future research.

Response to the Research Questions

The purpose of this study was to examine the relationship between structured and unstructured movement opportunities and number of ADHD-related movements in students with ADHD in a classroom environment. This section presents the research questions for the study and the conclusions from the data in response to these questions. The two questions posed in this study were as follows:

1. What is the relationship between movement and the amount of ADHD-related behaviors in students diagnosed with ADHD?

2. What is the variation in the hyperactive behavior of students with ADHD when structured versus unstructured movements are incorporated?

The responses to these questions are presented below along with a discussion of how the findings relate to these questions.

Research Question #1: What is the relationship between movement and the amount of ADHD-related behaviors in students diagnosed with ADHD?

Providing students with opportunities for unstructured movement has shown to be helpful in either decreasing ADHD-related behaviors or in channeling those behaviors into different forms of stimulation. The data from this study also supported the theoretical foundation of the study, the Optimal Stimulation Theory, which suggests hyperactive behaviors occur as a result of insufficient stimulation (Zentall, 2010). OST holds that a student will create stimulation himself if the optimal level has not been met. Since each of the four subjects responded to the unstructured treatment, this suggests these students were exhibiting ADHD-related behaviors during the baseline period due to a need for additional stimulation. The results from this study seem to support this idea, as students channeled their hyperactive behaviors during the unstructured movement treatment period through the use of therapy balls and bouncy bands. Once the stimulation was provided in the form of unstructured movement, the amount of ADHD-related behaviors decreased significantly.

Ball vs. Band

Students engaged with the therapy ball and the bouncy band during the unstructured movement treatment. Students were provided with both and allowed the freedom to engage with each as they desired. On average, the students bounced the ball 40 times during a 10-minute interval, with a high number of 78 bounces in any one period. As for the bouncy bands, students interacted with them an average of 10 times during a 10-minute interval. Each student had a minimum of one 10-minute interval during which they did not interact with the bands at all. When given the choice, the students interacted with the ball rather than the band. The students who only interacted

with the bands 4 or fewer times in a 10-minute interval also interacted with the therapy balls from 10 to 48 times in that same interval. This shows there does not appear to be any direct or inverse relationship between the ball and band. Student J interacted with the therapy ball and bouncy band at a higher rate that the other three students. This may suggest that within the intervention of unstructured movement, the therapy ball is the preferred tool for students as it saw more use than the bouncy bands.

Data from this study showed an increased amount of hyperactive behavior displayed by Student J near the end of a class period, a time during which he would have been waiting to switch classes. This finding supports the literature. According to the literature reviewed, subjects with ADHD often exhibited hyperactivity during periods of waiting, possibly exhibiting a need to create stimulation during this time (Laver-Bradbury, 2011).

Unstructured and structured movements applied as interventions for students with ADHD in a public school setting could be effective depending on students' individual needs. Unstructured movement could be applied more broadly as an intervention with students with ADHD, with structured movement incorporated with students who seem to exhibit more ADHD-related behaviors on average. Rather than decreasing stimulation by removing potential opportunities for distraction, students with ADHD can benefit from increased stimulation when provided means for controlled movements.

Research Question #2: What is the variation in the hyperactive behavior of students with ADHD when structured versus unstructured movements are incorporated?

Implementing structured movements in the form of brain breaks consistently throughout a 60-minute class period did not seem to be effective in reducing the amount

of ADHD-related behaviors manifested by a student with ADHD, as shown by three out of the four subjects in this study. These three subjects exhibited a combined count of 381 ADHD-related behaviors during the baseline period with no interventions applied. When the structured movements were applied as an intervention, the students exhibited a combined count of 362 ADHD-related behaviors, an amount practically indiscernible from their baseline behavior without any sort of intervention. A teacher with students similar in disposition to Students C, S, and Z, would have little incentive to apply this intervention when the results did not prove to be effective.

However, Student J not only responded to the unstructured movement treatment, but also to the structured movement treatment. Out of four subjects, Student J is the only one who continued to show improvement when the structured movements were implemented. ADHD is a heterogeneous disorder and is manifested differently in each student. Data from this study indicates that treatments for this disorder may also be heterogeneous; what works for one student may not necessarily be successful with another student.

Although Student J has been diagnosed with ADHD, he exhibits behaviors suggesting comorbidity with other disorders, such as anxiety and obsessive-compulsive disorder. Because of this possibility, his increased level of ADHD-related activity could be partially due to other disorders. Additionally, his response to structured movement could be due in part to this treatment addressing symptoms of his other possible disorders instead of addressing symptoms of ADHD (Tarver, Daley, & Sayal, 2014; Faraone & Kunwar, 2007).

Implications of the Findings on Classroom Practices

With 1 in 9 students between the ages of 11 and 14 diagnosed with ADHD, teachers are bound to encounter students with this disorder in their classroom (Centers for Disease Control and Prevention, 2014). However, little to no training is provided to these teachers regarding strategies that will reduce the number of ADHD-related behaviors and increase the learning potential of all students (Ek, Westerlund, Holmberg, & Frenell, 2011).

The findings from this study are supported by the literature in suggesting unstructured movements be implemented as an intervention strategy for students with ADHD (Tine & Butler, 2012; Burgoyne & Ketcham, 2015; Wu et al., 2012; Schilling, 2003). Students who engaged in movement on therapy balls and bouncy bands exhibited fewer ADHD-related behaviors than when they did not have access to this technology. The manifestation of fewer ADHD-related behaviors would imply less time is spent off-task in the classroom. More time on-task in the classroom can lead to higher achievement (Sarver, Rapport, Kofler, Raiker, & Friedman, 2015; Wu et al., 2012; Schilling, Washington, Billingsley, & Deitz, 2003). A teacher using unstructured movement as an intervention in the classroom with students with ADHD might discover the students producing fewer distracting behaviors, which could lead to increased time on-task for students with this disorder.

Not only would teachers benefit from receiving training on the available interventions, but also classrooms with students with ADHD should have access to the equipment necessary to make these interventions successful. School districts serving a

population of students with this disorder should make it a priority to supply classroom teachers with the appropriate equipment.

It is in the best interest of students with ADHD for classroom teachers to have access to tools that provide opportunities for unstructured movement in the classroom. During the data collection phase of this study, the subjects repeatedly requested access to the therapy balls and bouncy bands. Once these interventions have been applied in a classroom setting, it could be beneficial for teachers to allow students access to these tools upon request.

Although brain breaks are commonly used in classrooms, little research has been conducted on the effect of using structured movements such as brain breaks as interventions with students with ADHD. The results of this study showed three out of four students produced only 20 fewer ADHD-related behaviors in response to the structured intervention than without any intervention in place.

However, based on Student J's response of a 69% decrease between the baseline and structured period holds significant implication for classroom practices. Disorders manifest themselves differently among students (Brown, 2016; Reiber, & McLaughlin, 2004). and no two students are exactly alike. A teacher with a student similar in profile to Student J would be apt to use this intervention for multiple reasons. A decrease in ADHD-related behaviors could translate into the student with the disorder spending more time on task and raising his achievement level as a result, the students in the classroom spending less time distracted by the student's behaviors, and the teacher spending less time responding to and redirecting the student's off-task behaviors.

Recommendations for Future Research

Future research should include a larger population of subjects. This study was conducted with a small group of four 11 and 12 year-old students in the sixth grade and could be replicated among higher or lower grade levels. Future research could also include conducting observations during different times during the school day and in various subject areas.

Future research could be conducted as a longitudinal study by comparing the amount of ADHD-related behaviors exhibited over time in response to a treatment. Future research could also observe the effect of a combined treatment of unstructured and structured movement on students with ADHD. Providing students with ADHD the autonomy of choice between treatments after being introduced to several treatments could also affect the benefits of the intervention.

A future study with an ABAB design (Ary, 2010) could investigate the long-term effects of unstructured treatment when students are introduced to the intervention and then the treatment is withdrawn. Results could reflect if a dependency on the unstructured treatment to manage behavior was present in students with ADHD.

The students involved in this study demonstrated, on average, a higher number of ADHD-related behaviors near the end of the 60-minute class period. It would be informative in a future study to investigate any relationship between the amount of ADHD-related behaviors exhibited and the type of work being completed in a classroom. In addition, more information is needed on the longevity of the effectiveness of unstructured movement as an intervention. Since the subjects in this study displayed an increase of ADHD-related behaviors near the end of the observed class period, a future

study could investigate the effectiveness of implementing the unstructured movement as an intervention over a longer period of time.

Future research could also implement different types of unstructured movements as an intervention using treatments other than therapy balls and bouncy bands. In addition, future research could concentrate on just the therapy balls, seeing as the research from this study indicates them as a preferred tool.

In this study, the two types of interventions applied were different in several ways. The unstructured movement as an intervention was provided as a choice to students; they could control what they interacted with and how frequently. The structured movement as an intervention was provided as an instruction to students; the teacher controlled and directed how they moved and how frequently. Future research could investigate the significance of the nature of these treatments and seek to discover if the variables of student choice and control contributed to the effectiveness of the treatments.

Consider the variability of the amount of ADHD-related behaviors exhibited between students across the three periods of treatment. Future research might investigate how students with ADHD exhibiting hyperactivity impacts students without ADHD in the classroom, and whether the level of consistency in these behaviors have an effect on the attentional ability of students without ADHD. Future research could also focus on whether or not a lower level of ADHD-related behaviors exhibited by students translates into the classroom teacher spending less time on correcting off-task behavior and an increased amount of time on content instruction. Continued studies could also determine any benefits to the student beyond lowering the level of ADHD activity. Studies involving classes of students engaging in a variety of activities may help to determine if

lower levels of ADHD-related behaviors result in higher completion of assigned in-class activities and retention of the subject matter under review.

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Appendix A

Information Letter and Consent Form for Parents or Guardians
Permission for Research with Children

Date

Dear **Parent(s) or Guardian(s**):

I am writing to ask your permission for your child to participate in a Carson-Newman University research project on incorporating movement into the classroom environment. This project will be conducted at East Tennessee Middle School over the next several months. We are interested in identifying the types of movements deemed most effective in reducing the number of ADHD-related behaviors. Types of movement that will be incorporated include being seated on an exercise ball, use of bouncy bands, brain breaks, and stretches. Our project may help us understand more about children's behavior when movement is incorporated.

The project in which your child has been invited to participate is expected to be an enjoyable experience and will take place in the classroom environment along with peers. However, the decision about participation is yours. All children's performances are considered confidential and individual children's results will not be shared with school staff. Only children in 6th grade who have parental permission, and who themselves agree to participate, will be involved in the study. Also, children or parents may withdraw their permission at any time during the study without penalty by indicating this decision to the researcher. There are no known or anticipated risks to participation in this study.

I would like to assure you that this study has been reviewed and approved by the Research Ethics Review Board at Carson-Newman University. In addition, it has the support of the principal at your child's school. However, the final decision about the participation is yours. Should you have any concerns or comments resulting from your child's participation in this study, please contact Christopher Shon at Carson-Newman University at cshon@cn.edu.

We would appreciate it if you would permit your child to participate in this project, as we believe it will contribute to furthering our knowledge of classroom strategies that will be useful in keep a child's attention. Please complete the attached permission form, whether or not you give permission for your child to participate, and return it to the school by February 5th.

If you have any questions about the study, or if you would like additional information to assist you in reaching a decision, please feel free to contact me, Allison Dempsey, at amdempsey@cn.edu, or my faculty supervisor, Dr. Mark Taylor, at ptaylor@cn.edu. Thank you in advance for your interest and support of this project.

Sincerely,

(Signature)

Allison Dempsey

Carson-Newman University

(Signature)

Dr. Shon
Committee Chair
Carson-Newman University

Appendix B

Consent Form – Child

I have read the information letter concerning the research project entitled "Movement and Behavior" by Allison Dempsey of the Department of Education at Carson-Newman University. I have had the opportunity to ask questions and receive any additional details I wanted about the study.

I acknowledge that all information gathered on this project will be used for research purposes only and will be considered confidential. I am aware that permission may be withdrawn at any time without penalty by advising the researchers.

I realize that this project has been reviewed by and approved by the Research Ethics Review Board at Carson-Newman University, and that I may contact this office if I have any comments or concerns about my son or daughter's involvement in the study.
If I have any questions about the study I can feel free to call the researcher
Allison Dempsey
615-336-3191
amdempsey@cn.edu

☐ Yes – I would like my child to participate in this study

☐ No – I would not like my child to participate in this study.

Child's Name **(please print)** _____

Child's Birth Date _____ Gender of Child ____ Male ____ Female

Parent or Guardian Signature _____ Date _____

Researcher's Signature _____ Date _____

Researcher's Title _____ Department _____

Faculty Advisor Signature _____ Date _____

Faculty Advisor Title _____Department_____

Appendix C

Phase I: The researcher will use the following data collection tool in observing students with ADHD in a natural classroom environment. This observation will take place over the course of one 60-minute class period, during which the researcher will tally the number of ADHD-related behaviors in order to create a baseline. Behaviors related to hyperactivity: blurting out, squirming, fidgeting, out of seat, excessive movements. Behaviors related to inattention: daydreaming and/or focusing on something other than directed.

Phase I Table

Date	Hyperactivity	Hyperactivity	Hyperactivity
	Start Time: End Time:	Start Time: End Time:	Start Time: End Time:
Student A			

Phase II: The researcher will use the following data collection tool in observing students with ADHD in a classroom environment in which Treatment A, unstructured opportunities for movement, has been applied to the student.

Phase II Table : Unstructured Movements

Time Student A	Start Time: End Time:	Start Time: End Time:
Therapy Ball		
Bouncy Band		

Hyperactivity		

Phase III: The researcher will use the following data collection tool in observing students with ADHD in a classroom environment in which Treatment B, structured strategies involving movement, has been incorporated in 10-minute intervals. The researcher will tally the number of occurrences of hyperactive and inattentive behavior.

Phase III Table: Structured Movements Table

Time Student A	Start Time: End Time:	Start Time: End Time:	Start Time: End Time:	
Hyperactivity		Type of Movement Used: Brain Break/ Structured	Hyperactivity	

Appendix D
Data from Baseline, Unstructured, and Structured Observations

Time	Student	B	UN	S
8:30-8:40	Student C	13	49	29
8:40-8:50	Student C	25	28	3
8:50-9:00	Student C	17	25	4
9:00-9:10	Student C	20	67	2
9:10-9:20	Student C	33	48	5
9:20-9:30	Student C	20	56	18
8:30-8:40	Student J	46	10	34
8:40-8:50	Student J	64	2	30
8:50-9:00	Student J	97	2	30
9:00-9:10	Student J	86	2	16
9:10-9:20	Student J	56	0	35
9:20-9:30	Student J	77	3	42
8:30-8:40	Student S	12	8	37
8:40-8:50	Student S	27	1	28
8:50-9:00	Student S	33	2	9
9:00-9:10	Student S	35	4	12
9:10-9:20	Student S	42	7	28
9:20-9:30	Student S	39	7	14
8:30-8:40	Student Z	8	4	46
8:40-8:50	Student Z	9	6	5
8:50-9:00	Student Z	14	0	10
9:00-9:10	Student Z	11	2	42
9:10-9:20	Student Z	13	18	8
9:20-9:30	Student Z	10	22	19