

The Impact of Physical Activities on Children with Attention Deficit Hyperactivity

Disorder's Ability to Focus

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Abstract

Children diagnosed with ADHD typically have academic difficulties and trouble completing assigned tasks. The presence of ADHD is associated with behavioral problems as well as staying focused (i.e., difficulty staying on task, shouting out answers in class). It is important to identify effective interventions for children with ADHD. Physical activity as an intervention in the classroom has been found to impact some of the difficulties students with ADHD may present. The following research includes a three-week period of a baseline, intervention, and post-intervention observations with one third grade, male student. The data was recorded using a measurement of frequency of target behaviors. The intervention was found to increase the target child's ability to focus in the classroom and displayed improvement in his overall attitude about math class.

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An increasing number of children are being diagnosed with Attention Deficit Hyperactivity Disorder (ADHD). According to *Cognitive Factors of Attention and ADHD*, “ADHD affects 5% to 10% of school-aged children” (2005, p. 423). Consequently, teachers will undoubtedly come in contact with a student with such a disorder at some point in their career (Harlacher, Roberts, & Merrell, 2006). It is important to recognize the symptoms and characteristics of ADHD to understand a child with this disorder and know how to help him or her in the most appropriate way.

ADHD Defined

ADHD can be defined as “a neurobiological behavioral disorder characterized by chronic and developmentally inappropriate degrees of inattention, impulsivity, and in some cases, hyperactivity” (Rief, 2005, p. 3). According to the Companion Guide to the Diagnostic and Statistical Manual of Mental Disorders (4th Ed. - TR), the diagnostic criteria for ADHD, specifically *hyperactive type*, are as follows:

- a. often fidgets with hands or feet or squirms in seat, b. often leaves seat in classroom or in other situations in which remaining seated expected, c. often runs about or climbs excessively in situations in which it is inappropriate, and d. is often “on the go” or often acts as if “driven by a motor,” often talks excessively.
- (First, Frances, & Pincus, 2004, p. 381)

For the *Inattentive subtype*, criteria include:

- a. often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities, b. often has difficulty sustaining attention in tasks or playing activities, c. often does not seem to listen when spoken to

directly, and d. often easily distracted by extraneous stimuli. (First et al., 2004, p. 381)

ADHD can lead to behavioral and academic difficulties in the classroom as students struggle to stay on task, shout out answers, and have difficulty finishing their work (Harlacher et al., 2006). Because students with ADHD create special challenges in the classroom, teachers should be ready to respond accordingly with proper techniques and strategies to maintain a stable learning environment.

Physical Activity Defined

Regular physical activity has been suggested as a technique to help students with ADHD in schools (Azrin, Ehle, & Vinas, 2006). The use of regular physical activity is investigated further in this paper. Physical activity has been defined by the Surgeon General of the U.S. Public Health Service as, “bodily movement that is produced by the contraction of skeletal muscle and that substantially increases energy expenditure” (Manley, 2004, p. 21). According to the Ontario Physical and Health Education Association, (OPHEA, 2006) there are two types of physical activities: vigorous and moderate. Examples of vigorous physical activities include jogging or aerobic movement that is done outside, in the gymnasium, or a large open area. Moderate physical activities include brisk walking, recreational dancing, or doing daily chores or exercises that can be done inside the classroom or hallways.

Azrin et al. (2006) suggest that for children with hyperactivity, vigorous scheduled physical activity might be effective to reinforce calmness and as a means of increasing students’ academic performance. According to Am (2005), “Physical activity elevates brain chemicals that individuals with ADHD are short on” (p. 50). This research

investigated regular physical activity as a possible strategy and explored if expanded physical activity benefits students with ADHD by increasing attentiveness and decreasing hyperactivity, leading to increased focus in the classroom.

Educators and parents are concerned about their students and children. Exploring this topic/strategy may help address concerns about children with ADHD and their ability to focus. According to Reif (2005), it is important for parents and teachers to educate themselves in this area in order to successfully advocate for their child/student with ADHD.

Literature Review

In this review of the literature, expanded physical activity as an intervention to benefit students with ADHD is explored, and information is divided into four categories for ease in understanding. The first section compares studies that present interventions designed to increase attentiveness in children with ADHD. The second includes research involving physical activity in general, relating to children with ADHD or other behavior disorders. The next section examines the effects of different medications prescribed for children with ADHD. Finally, a summary of the findings and an analysis of the connections between all areas of research is presented.

Studies with Specific Interventions to Increase Attentiveness

While much of the literature has focused on educational constructs pertaining to individuals with ADHD, there is paucity in the literature as it pertains to exploring their unique attentional characteristics. This study compared 27 children diagnosed with ADHD to 15 children in a control group. Various motor batteries were used to determine differences in the groups in their selective attention, executive attention, sustained

attention, and orienting of attention. Results indicated that children with ADHD scored worse than the controls on each construct, primarily sustained attention. Specifically, they had difficulty in sustaining attention to relevant information over a relatively long period of time while withholding responses to irrelevant responses (sustained attention deficits). They had difficulty in effectively ignoring irrelevant distracting information when performing a perceptual act on relevant information (selective attention deficits). They had difficulty benefiting from a cue that automatically attracted attention to a specific location or failure in disengaging and reorienting attention to a different location (orienting different objects) (Tsal, Shalev, Mevorach, 2004). These findings are of significance to professionals interested in the etiology of attention deficits.

Abromowitz and O'Leary (1991) focused on how educators attempted to minimize the impact of youngsters' distractibility and hyperactivity by providing a muted, minimally stimulating environment. Cubicles were provided to increase students' concentration. The authors concluded that findings did not support this as a useful approach, however, because keeping students quiet and minimally stimulated is not developmentally appropriate (Abromowitz & O'Leary).

Seating arrangements for students have also been suggested as a way to benefit students with behavioral problems, with circle seating being particularly useful for helping students stay on task (Abromowitz & O'Leary). For example, "circle seating may facilitate on-task behavior for discussions and other teacher-led instruction" (p. 221). Circle seating allows for a more open area that enables students to see the teacher better, and the teacher to keep an eye on his/her students.

While this suggestion may prove beneficial, the study did not specifically use students with ADHD, so the usefulness for that population is not known. However, since children with ADHD exhibit high rates of off-task behavior, these findings are definitely relevant to this review.

Azrin et al. (2006) evaluated a four-year old boy with ADHD to determine whether scheduled vigorous activity served to reinforce calmness. The child was not on any type of medication for his ADHD symptoms. His teachers described him as ‘disruptive and said that he never stops moving’ (p. 565).

At the beginning of the study, a baseline was recorded of the child’s attentive sitting during his normal 17-minute classroom circle-time setting. A response was defined as nonattentive if he jumped out of his seat or positioned his head and body substantially away from the teacher to engage in a non-task relevant behavior. The 17-minute period was divided into 1-minute intervals. (Azrin et al., 2006, p. 565-566).

Azrin et al. (2006) observed the child in a separate room (laboratory setting) in five different conditions, each on a separate day. The conditions included:

1. *Shaping*, or trying to get the child to sit attentively for a short amount of time and increasing time after each duration was achieved. This was accompanied by descriptive praise, then allowing him to go to the playground when duration was achieved; 2. *Descriptive Praise*, (e.g., You’re sitting so still, you’re looking right at me, your hands and arms are so relaxed. (Azrin et al., p. 566)

This was the only incentive for the child. The playground was not used as a reinforcer for this condition; 3. In the *Noncontingent reinforcement* condition, there was no descriptive praise for positive behavior, just the opportunity to play on the playground; 4. In the *Reconditioning* condition, reinforcement was given throughout the session for the same duration achieved at the first reinforcement session. Descriptive praise was included.

Finally the last condition, *Baseline*, was simply having the child sitting in a seat with no reinforcement. When he got up from his seat, he was taken right back to it for the next trial. Azrin et al. (2006) explained that when the child was given time to play outside on the playground (reinforcement), this meant he had the opportunity to play with typical gymnastic equipment (slides, ladders, swings, rotary wheels, climbing structures, etc.) It was made clear that as soon as the child earned his break, he “immediately and continuously engaged in vigorous activity with this equipment with no prompting” (Azrin et al., p. 566).

During the initial baseline, the child was inattentive for 100% or 17/17 of the one-minute observation intervals (Azrin, et al., 2006) indicated by movements of his arms, legs and other body parts and the teacher continuously redirected him to his seat. The results demonstrated that the child’s attentive sitting increased when activity was used as a reinforcer. In fact, the authors conclude by saying, “The boy’s overall manner appeared greatly improved during the reinforcement condition. Several teachers and school personnel who incidentally observed him at that time commented that his face, gaze, mouth, and body were notably relaxed and normative” (p. 568).

“One general guideline for identifying a reinforcer is the Premack Principle that states high-frequency behavior will serve as a reinforcer for low-frequency behavior”

(Azrin et al., 2006, p. 565). According to Ayllon and Azrin (as cited in Azrin et al.), “This principle was used in the original token economy. It suggests that for children with hyperactivity, the opportunity for vigorous scheduled activity paradoxically might be effective as a reinforcer for calmness” (p. 565).

Token economies are used in behavior modification interventions and involve rewarding desirable behaviors with tokens that can be exchanged for items or privileges. It can also be used to punish undesirable behaviors by taking away tokens. This strategy is widely used in classrooms. However, Azrin et al. (2006) argue that using physical activity as a reinforcer or reward can increase the effectiveness of a contingency management treatment, which is defined as “the application of consequences dependent on specified child behaviors” (Abramowitz & O’Leary, 1991, p. 222). This approach involves providing positive reinforcement for certain appropriate behaviors in an effort to increase their frequency. Much of the research focuses on contingency management as one of the most common behavioral management techniques for children with ADHD.

On the other hand, some research does not support a token economy or a reward system for students who exhibit inappropriate behavior. Self-motivation and self-regulation were utilized in another collection of studies. Alfie Kohn, a critic and speaker on human behavior and education, noted that giving a piece of candy or rewarding the child with something every time he/she does something correct, is not a constructive way to modify behavior (Brandt, 1995). He believes that children shouldn’t have to “earn” our approval, but should be intrinsically motivated to learn and teachers should encourage their desire to learn (Brandt).

A limitation to Azrin's (2006) study is that the child had a comorbid diagnosis of autism, and attended a day school for children with autism. In addition, only one participant was being studied, so it is difficult to generalize to the whole population of children with ADHD. The study also says nothing about a follow-up with the child, which makes it difficult to know if the intervention continued to be successful over time.

Using B.F. Skinner's theories, Crain (2005) performed numerous experiments showing that human behavior, beginning in infancy, can be controlled by reinforcing stimuli (p. 121). Therefore, using positive reinforcement to achieve a desired behavior is becoming more prevalent in classrooms with children with not only ADHD, but other behavioral disorders as well (Crain).

A similar study conducted by Azrin, Vinas, & Ehle (2007), in a special education classroom, evaluated two 13 year-old boys with ADHD. The baseline recorded inattentive and restlessness when students were engaged in a normal classroom routine. A response was defined as in the earlier described Azrin study (Azrin et al., 2007). The results exhibited a mean of 100% regarding the measure of restlessness and inattention.

The "shaping" period consisted of a 4-day period with a very short duration of calmness as the initial response requirement, due to the high baseline level of the participants' inattentive restlessness. The intended reinforcer was a chance to play in a recreational area, where the children were observed to engage in vigorous activity with the play equipment immediately and continuously with no prompting. This qualified as a high frequency behavior in the context of the Premack Principal, just like in Azrin et al.'s (2006) previous study with the four year-old child.

The results for both 13 year-old boys with ADHD were very similar. They were attentively calm during all intervals during the ‘activity as a reinforcer’ condition. Also, the overall manner of the boys was notably improved and normal. When comparing the results of both Azrin et al.’s studies (2006, 2007), it is evident that engaging in physical activity as a reinforcer for calmness and improved classroom conduct was a successful intervention for children with ADHD.

One of the study’s limitations was that the two 13 year-old boys with ADHD were also diagnosed with moderate mental retardation, having IQ scores of 44 and 45, respectively. They were also enrolled in a special education class, in a public school, for children with severe emotional disturbances and mental disabilities (Azrin et al., 2007).

Physical Activity and Children with ADHD or Other Behavior Disorders

It can be difficult for a general education teacher to focus on a vigorous physical activity intervention for one specific student while he/she is in charge of the learning for twenty children, yet the intervention can be incorporated into the whole classroom.

According to Ontario Physical and Health Education Association (2006),

daily physical activity can be incorporated into the schedule of the whole school in a variety of ways, such as in all classrooms after morning or afternoon announcements, with the entire school together, outdoors or in the gymnasium, as appropriate, at regularly scheduled times, on a rotating schedule so that the same subject is not always affected, or part of special events taking place during the school day (e.g., seasonal celebrations, school spirit days, community events) (p. 20).

If the physical education, regular education, and/or other teachers worked together to make sure physical activity was being incorporated into the entire school day, then an individual intervention for the child with ADHD may not be necessary.

Sometimes it can even be challenging for teachers to have students engage in physical activity in a regular classroom as a whole. This situation can be overcome by having students be active in the morning: “Exercise in the morning (for example, a before-school jogging program or some kind of aerobic workout) may increase a child’s academic and behavioral performance” (Rief, 2005, p. 429). This could also serve as a reinforcement at home for a child with ADHD. Therefore, a child can start the day off already having some sort of physical activity even before school starts. It is likely that due to time constraints and inconvenience, physical activity may not be supported by classroom teachers. However, many teachers have experienced the benefits of physical activity for their classrooms and students with ADHD.

In order for educators to incorporate vigorous physical activity into every school day for every child, teachers should understand why physical activity helps children with ADHD in particular. Children with ADHD tend to struggle academically because it is difficult for them to focus in the classroom, especially in the area of reading (Rief, 2005, p. 10). Therefore, it is important for teachers to utilize a behavior intervention plan or some type of positive reinforcement for on-task behavior, which Azrin et al. (2006) demonstrated can be accomplished through physical activity.

Because the ability to focus is essential to learning, classroom intervention is a crucial component of a comprehensive treatment for ADHD. Abramowitz and O’Leary (1991) argued that, “in addition to implementing the needed classroom approaches,

educators should become advocates for high-quality services to these youngsters outside the school domain” (p. 231). Accordingly, with proper training, teachers may be able to better adapt their classroom environment and management plan to better incorporate a more physically active curriculum and/or environment.

Cooley (2007) agrees that incorporating physical activity into lessons will provide more physical activity opportunities for children with ADHD. He added this may be as simple as having the children walk to the front of the class to respond to questions or write answers on the board. These strategies help all students, not just children with ADHD. Harlacher et al. (2006) agree stating, “the use of classwide interventions has a distinct advantage because their application can benefit all of the children in the classroom and not just the student with ADHD” (p. 6).

Rief (2005) points out that, “Some benefits of exercise include a boost in mood, an increase in focus, alertness, learning, and memory” (p. 429). Although there is a lack of research on the impact of physical activity specifically for children with ADHD and their ability to focus, there is evidence to support the idea that physical activity benefits children with behavioral and/or learning problems, keeping in mind that no two children are the same and any given intervention may be more useful for one child than another. That being said, most children like to be active, especially children with ADHD who have hyperactivity and a short attention span. For them, physical activity is shown to be a positive reinforcement to encourage more focus in the classroom (Rief).

Medication and ADHD

Research demonstrates a positive impact of physical activity on the attention span of a child with ADHD, although there are limitations and conditions that can alter the

intervention and/or the results. Even when interventions are in place, many children with ADHD are also prescribed medication to help manage the disorder. According to Cutter, Segal, Segal, and Smith (2008), stimulant medications are the most commonly prescribed medication for children with ADHD. In particular, Ritalin, Adderall, and Dexedrine are used most often.

Rief reports that, “the greatest effects of the stimulants are on the core symptoms of hyperactivity, impulsivity, inattention, and associated features of defiance, aggression, and oppositionality” (2005, p. 37). These medications can increase interaction with teachers, parents, and peers, and also improve classroom performance (Rief). Notably, stimulant medications do have side effects that include, occur “initial headache, stomachache, delay of sleep onset, and reduction of appetite” (Reif, p. 37). Rief also cautions against a “rebound phenomenon” which is a worsening of ADHD symptoms, such as moodiness, irritability, less compliance, and more activity as the medication wears off.

According to Poncin, Sukhodolsky, McGuire, and Scahill (2007), “20-25% of patients with ADHD will not achieve a beneficial response to stimulant medication either due to lack of efficacy, or unacceptable adverse affects” (p. 79). Because all students do not respond successfully to medications, it is important to find another method or intervention that will benefit a student with ADHD, such as physical activity. It is also imperative to reiterate that no two children are the same; therefore some may respond better to medication, while others will not and may respond better with an intervention or therapy program.

In general, research offers suggestions for strategies and interventions that work for children with behavioral problems. However these are not always specific for children with ADHD. Research on the impact of physical activity on a child with ADHD and his/her ability to focus in an academic setting is lacking. According to Harvey and Reid (2005), “Few reviews have been written about the movement performance and physical fitness of persons with ADHD, with no book chapters or reviews devoted specifically to conducting physical activity research for persons with the disorder” (p. 18). Therefore, it is important to take the information and studies that are present and continue further research in the area of physical activity as an intervention for children with ADHD.

In conclusion, Rief (2005) affirms that “When one is hyperactive, it helps to learn relaxation and stress-reduction strategies, as well as find positive outlets to channel one’s energy”(p. 425). As an educator, if students are hyperactive and having trouble paying attention during class, it is important to find a strategy that allows them to use that constructive energy so they are able to come back to the classroom more calm which will enable them to be more productive. It is also vital to consider the benefits and possible side effects of medications for children with ADHD. According to Rief (2005), “Typically, parents agonize over the decision and many try avoiding the medical route for years. No parent wants to have their child take a ‘drug.’ They often are fearful of the long-term effects” (p. 39). Consequently, it is crucial to understand the child and his/her needs before any type of intervention is put into place. After comparing studies and finding positive outcomes to physical activity as a reinforcer, its potential to be a successful intervention or stress-reduction strategy for many children with ADHD is evident. Considering the many benefits of physical activity in general, it may promote

overall wellness in not only children with ADHD or behavior disorders, but all young children.

Method

Overview

ADHD greatly affects school-age children; therefore this research focused on elementary age students, in particular, a third grade child. Additionally, research on ADHD focuses on such children's inability to pay attention in class and positively respond to academic instruction. This research involved an entire third grade class but specifically targeted a third grade student with ADHD who had a comorbid diagnosis of autism (Asperger's). His behavior was characterized by an inability to stay focused, attend or participate in math class, and excessive energy. This research employed various types of vigorous physical activities as an intervention for the third grade child with ADHD to increase his ability to focus during math class. The significance of this intervention was to provide the child another 'focus technique', enhancing his ability to be more productive in class. Although all students in the classroom participated, the exercises were exclusively designed for one student to boost his energy level and increase his focus during math class.

Design

This study employed a qualitative single-subject A-B-A design. The research took place over a three-week period. The first and third week were baseline observations targeting the child with ADHD. The intervention, during the second week, was performed during the first ten minutes of their math period, in place of the students' usual 'bell work' routine. The purpose of this time-line was to first, to determine the target

child's behaviors that needed to be improved; and next, the intervention (physical activities) was intended to help improve these behaviors; and finally, the post-intervention observation was to gather results and determine if the intervention was successful for this particular child with ADHD.

This research took place in an elementary school classroom in a school in rural Appalachian Midwestern state. The actual intervention occurred in the students' general education classroom which was comfortable and familiar to the students. The participants involved in this research included 18 third grade students who performed the exercises as a class, under the direction of the researcher. Students were directly observed by the researcher who also served as the facilitator during the exercises. The researcher specifically observed the target student with ADHD during the remaining math period throughout the intervention week, as well as during the pre- and post-observation weeks.

Participants and Setting

The participants in this research involved a third grade class of students in a rural, southeastern Ohio elementary school. Participants were all Caucasian American and primarily represented a diverse socio-economic status. The students did not have any visual or hearing impairments. Research was conducted during a 45-minute math period between 1:30 pm and 2:15 pm and did not disrupt the students' daily class schedule, except for the intervention phase that occurred during the first ten minutes of the class period, replacing their usual bell work. This research was conducted daily for three consecutive weeks in the months of May and June.

The target student was a male diagnosed with ADHD and a comorbid diagnosis of autism (Asperger's). He had a calm and quiet demeanor and seemed to be liked by all

classmates. The child was an average student but often needed redirection to stay on task whether in a small group or large group. He did his best when modifications were made to class work or tests, and according to his teacher he benefited from positive praise and one-on-one feedback. The two behaviors targeted during the intervention phase were characterized under ‘inattentive behavior’. The first behavior he displayed was an off-task behavior of playing with his pencil or other object on or in his desk. The second behavior was another off-task behavior of putting his fingers in his mouth or nose, or desk. During the baseline observation period, these behaviors were constant. Academically, the teacher reported the student earned average to above average grades, but he was in the lowest level math class. The teacher also added that if the student would pay attention and participate more in class, he would most likely do better academically.

Procedures

The overall objective of this research was to determine the effects of physical activity for a child with ADHD. A baseline of observation data of target behaviors was recorded and determined the first week. The target behaviors were measured by frequency, or the number of times the student engaged in these target (undesired) behaviors. The allotted time for this baseline was 30 minutes during math class. During the second week, (intervention), the researcher distributed an exercise guide to each student in the math class that included the order of the exercises and an area for them to record data about their individual progress. The researcher instructed and modeled stretching their bodies before the vigorous physical exercises began. Finally, the researcher stood in front of the room and instructed the students on how to do each exercise.

Students stood around the room, arms length apart, while the researcher directed each exercise. Desks and other classroom objects were pushed aside for safety purposes. A docking unit with an IPOD was placed in the front of the room for the intervention period as it provided motivation for the students to participate. The researcher did not record the number of males and females nor specific information about the other students' backgrounds as it was unnecessary for the research. Ten minutes was given each day for the exercise session. There were six different exercises employed during the ten-minute session. Each exercise lasted 45 seconds with about 30 seconds in between each exercise. During this time, the researcher assumed the role as the facilitator of exercise for the students. The researcher also observed the target student and encouraged him to participate.

The exercises included jumping jacks, up downs, running in place, bicycle kicks, wall jumps, and skipping in a circle while following the lead of the researcher. In between each exercise, students were to record the number of times they could do each exercise in the allotted time, excluding running in place and skipping which were recorded in terms of duration of participation (forty-five seconds). The following week, (post-intervention observation), the researcher observed and recorded the frequency of target behaviors of the student with ADHD during the same 30 minute period. No instruction by the researcher was employed. The head teacher continued with the normal instructional routine during the math period.

Data Collection

Throughout the three consecutive weeks of observations and intervention, three forms of data collection were used to document changes in the target student's behaviors.

Observations

First, a tally-recording system was used to identify the frequency of the child's target behaviors. Data was collected to compare the frequency of the child's targeted behaviors across the different observation periods. Each time the researcher observed the behavior occurring, a tally was recorded under that specific behavior. If the behavior lasted for long periods of time without any gaps, a tally was marked every ten seconds.

Researcher Reflections

Researcher reflections were recorded after observing the child with ADHD to capture his reactions and comments throughout the session. Immediately after each session, a reflection was written describing events and conversations. It was important to observe the manner in which he responded to math instruction and what factors may have triggered target behaviors during and after the baseline.

Student Survey Questionnaire

Another key data collection tool was a questionnaire distributed to the entire class. It was presented to the students on the last day of the intervention period. The simply-stated questions assessed the students' general feelings about the exercises to determine any changes in students' ability to focus during math class. The questionnaire asked questions in which students responded with a smiley face, which meant, "yes, I agree"; a neutral face, which meant, "maybe" or "I don't know"; and a sad face which meant, "no, I do not agree". There were a total of six questions, with the final question

being an open-ended question. An example question is, “Doing physical activities before class helps calm my body down so I can concentrate better and do my school work?” The final open-ended question was, “What are some new physical exercises you would like to do before class? If there are no exercises you would like to do, then just write ‘none’.” See Appendix for a copy of the questionnaire.

Results

After collecting data for three consecutive weeks, the researcher analyzed the data and formulated results. Frequency data, along with observations and interactions with the target child were all taken into consideration. Frequency data was converted to an organized chart, analyzed, and graphed. Observations and interaction notes are discussed below.

Baseline Observation

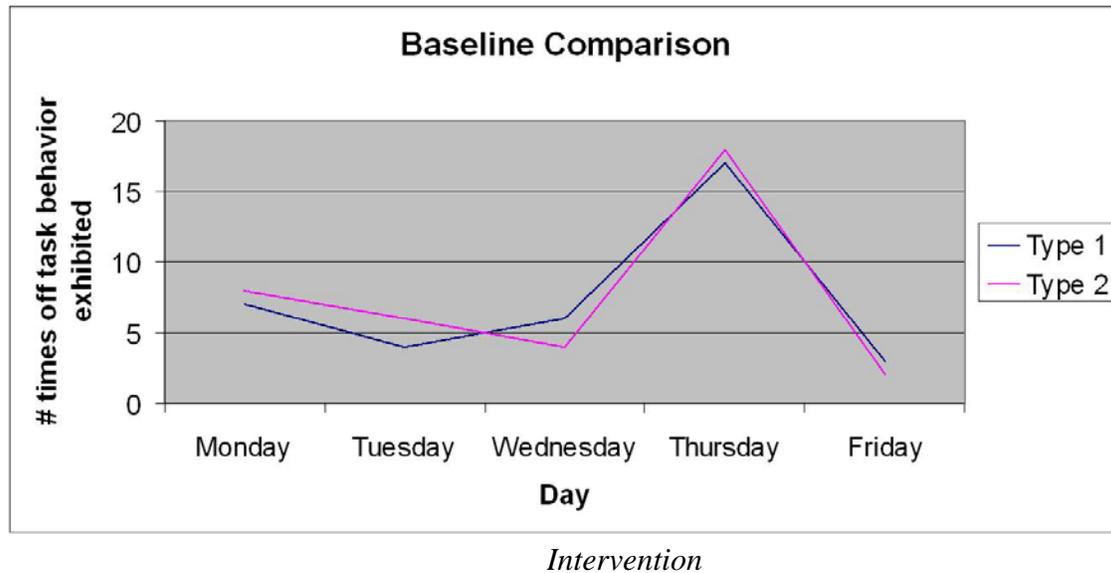
During the baseline period, the researcher sat in the back of the classroom and recorded each time the target student displayed the two target behaviors. A tally was recorded each time, unless a behavior happened for a consistent period of time. If this was the case, a tally was recorded every ten seconds. For example, if the student was continuously hitting two pencils together without stopping, the researcher would record a tally every ten seconds this behavior occurred.

The first day, the student was off-task as indicated by playing with his pencil seven times in a 30-minute period. He was off-task by putting his fingers in his mouth and or nose eight times in a 30-minute period. The baseline goal for the intervention was to decrease the frequency of both behaviors by half. The baseline for the target behaviors

was an average frequency of seven for the first behavior and an average frequency of eight for the second behavior during the 30-minute period. (See Figure 1).

Figure 1

Frequency of Off-Task Behaviors-Baseline



The intervention phase took place over five consecutive days. It consisted of six physical exercises: jumping jacks, up downs, running in place, bicycle kicks, wall jumps, and skipping in a circle around the room. These exercises were performed during the first ten minutes of math class. Although all students in the classroom participated, the exercises were exclusively designed for the target student with ADHD.

The researcher gave the students the option of either doing the exercises or sitting out if they were not comfortable doing them. The target student participated each day. Verbal praise was given to the target student every day to encourage his participation.

After the intervention, the researcher sat in the same area as during the baseline period observation and recorded tallies when target behaviors were displayed by the

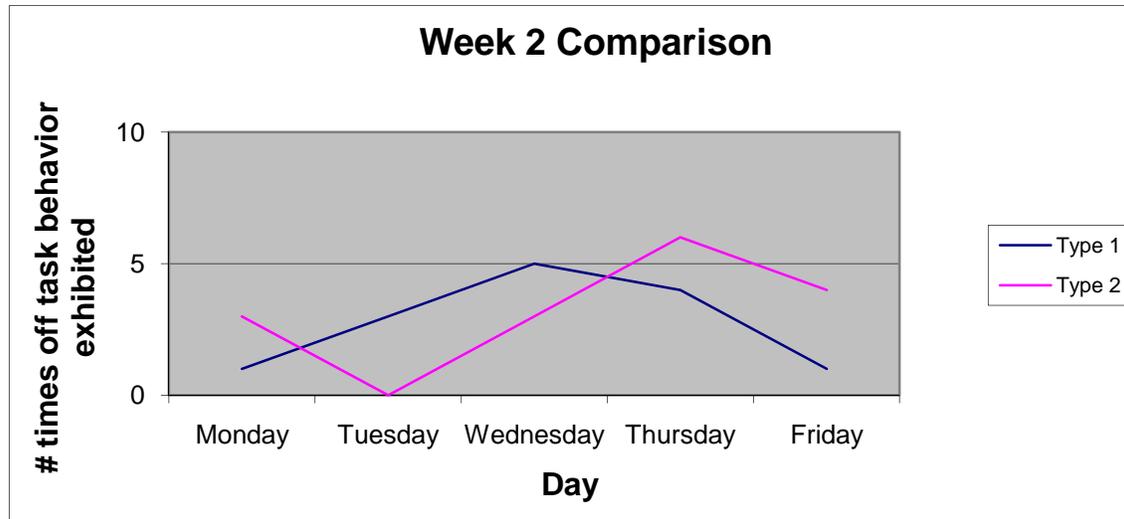
student with ADHD during the remaining time during math class. The same data recording technique was used for the intervention phase.

Compared to the baseline data, a decline in the frequency of the target behaviors was evident during the intervention phase. For example, day one the student exhibited off-task behavior by playing with his pencil one time during the 30-minute period. He was off-task by sticking his fingers in his nose three times during the 30-minute period.

The baseline for the first behavior, (playing with pencil or other objects), occurred at a frequency of approximately seven times during week one. The baseline for the second behavior, (hands in mouth/nose/desk), occurred approximately eight times during the first week. The average frequency for the first behavior during the intervention phase (week 2) was three times, while the frequency for the second behavior was also three times. (See Figure 2.)

Compared to the baseline during the first week, the researcher observed a decline in the number of times the child exhibited off-task behavior during the intervention week, indicating the projected goal was met.

Figure 2.

Frequency of Off-Task Behaviors-During Intervention

Student Survey Questionnaire

The student questionnaire was administered to the students immediately after the last intervention period, on Friday of week two. The target student answered each question, while the researcher read it aloud. Each response indicated the target student considered the exercises to be a good “focus technique” for math class. For example, he circled the smiley face for the first question, which was, “I can pay attention better to the teacher after I do some physical exercises.” At the end of the questionnaire, he told the researcher that he thought the exercises were hard, but he liked to do them.

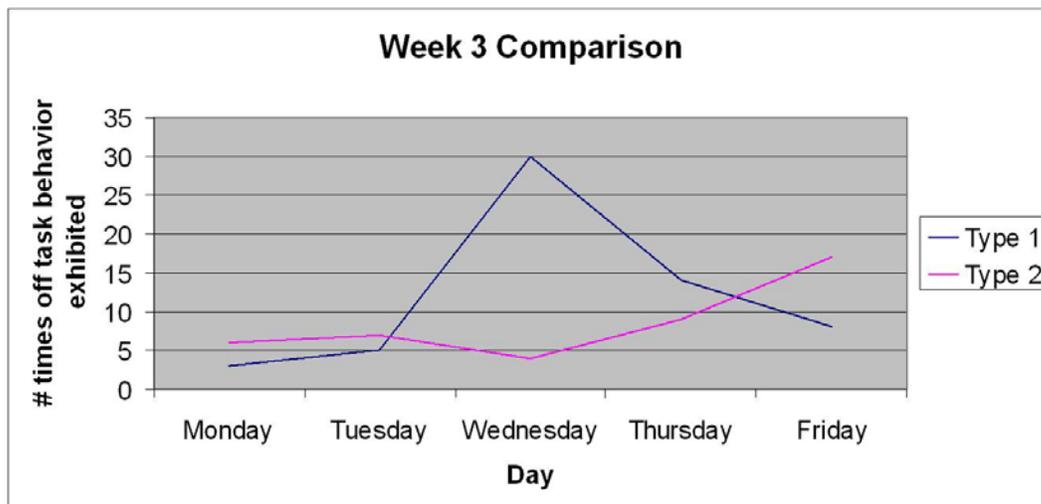
The researcher noted on the fourth day of the intervention, the student seemed more attentive and kept his hands to himself while doing the assigned work in math class. In addition, the student stood up while doing his work, but he rarely displayed the target behaviors.

Post-Intervention Observation

The post-intervention observation was similar to the baseline data collection period in that it involved observation with no intervention or praise. The researcher sat in the back and observed the child during the 30-minute math period. It was obvious that without the intervention, the frequency of the off-task behaviors once again increased. In fact, the average number of times the child exhibited the behaviors was dramatically higher than the baseline period. The child exhibited both behaviors throughout the 30-minute period. The average frequency for the first behavior was 12 times, while the average frequency for the second behavior was nine times. (See Figure 3.)

Figure 3.

Frequency of Off-Task Behaviors-Post Intervention



The child commented to the researcher during the second day of the post-intervention observation, “Why aren’t we doing the exercises this week?” He seemed to be discouraged that the intervention did not continue, which may have triggered his target behaviors even more so than before. The observational data, the anecdotal data, and the

student's attitude indicate that the physical exercises impacted his ability to focus and feelings about math class.

Summary of Results

After observing the target student during the intervention week, it was evident that the physical activities were a positive technique to increase his ability to focus during math class. Each day the researcher stood in front of the classroom and began the music to start the exercises, the target child immediately became attentive and walked toward the front to participate. It was obvious by his actions and positive attitude that he enjoyed the exercises. During observations directly following the exercises, the target child seemed more focused and eager to pay attention to the teacher. The researcher noticed that his participation in class increased and his willingness to ask questions improved as well.

A comparison of week one baseline data and the post-intervention observation data to the intervention week indicates the target student benefitted from the physical activities. This "focus technique" motivated the target student and increased his ability to focus during the rest of the math period. The target student said that he enjoyed the exercises and that he wished he could keep doing them. Figures 4 and 5 display the intervention goal of minimizing the frequency of the behaviors by half was successful and demonstrates the intervention had a positive effect on the child's ability to focus in math class.

Figure 4.

Average Frequency of Playing with Pencil by Week

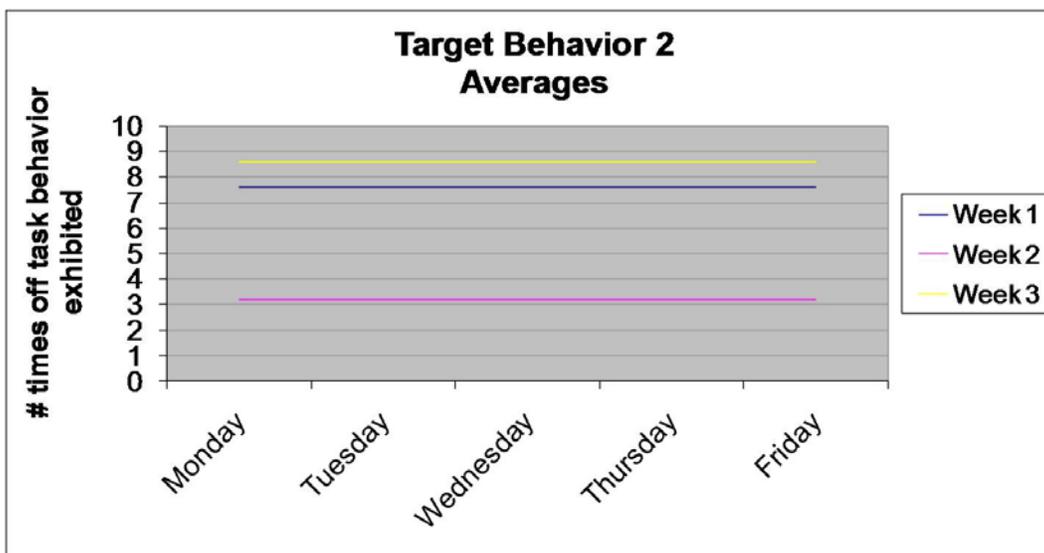
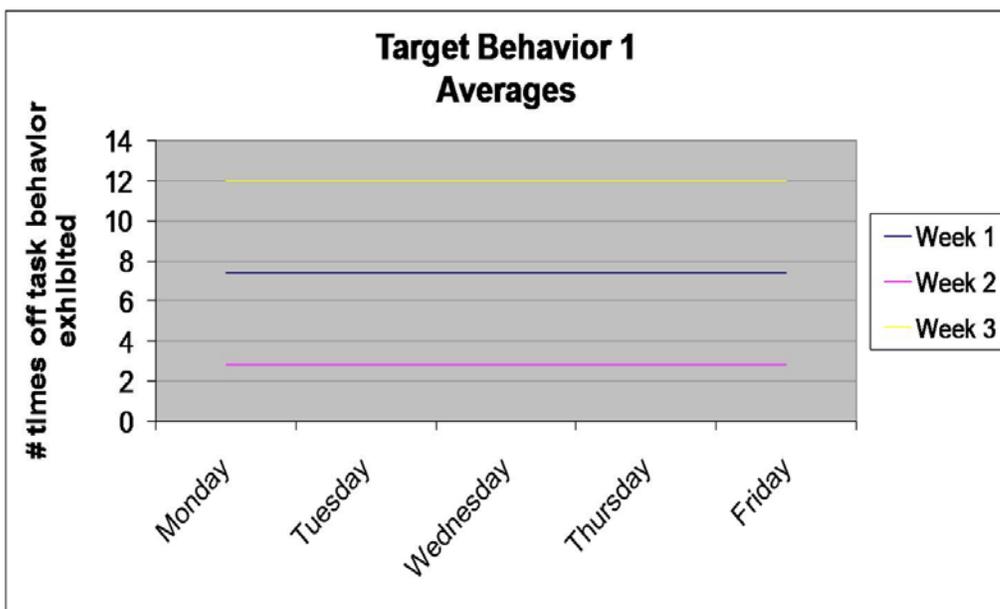


Figure 5.

Average Frequency of Fingers in Mouth/Nose by Week



Discussion and Conclusions

The goal of this study was to determine the impact of physical activity on a target child's ability to focus in an academic setting. Results indicate that when an intervention of physical activities was used with this particular child with ADHD, his ability to focus increased in math class. According to Cooley (2007), "It can be very difficult for children (diagnosed with ADHD) to stay still over the course of an entire class period. When possible, incorporate physical activity into your lessons" (p. 141). This case study indicated that taking ten minutes at the beginning of class to heighten the children's energy level and increase their motivation can also improve their productivity in the classroom.

Implementing a classroom physical activity as an intervention for a child with ADHD is something simple a teacher can employ to increase a child's attentiveness in class. In this case, the child was on medication, but the intervention still had a positive effect. Teachers have no say in whether or not children should or should not take medication, but they do have the power to implement an intervention that may increase children's attention span for a certain period of time while they are in the classroom. According to Kuo and Taylor (2004), "If untreated, a person with ADHD will struggle with peers and family members, and performance at school..." (p. 1580). If this intervention was continued with this particular child, his chances to improve his on-task behavior would be most likely to continue over time.

The positive link between physical activities and attentiveness also played a role in the target student's overall enjoyment in the classroom. The target student's exercise participation and ability to focus appeared to have a positive influence on his demeanor.

He smiled and wanted more physical exercises, displayed genuine interest in the challenge of the activities, and demonstrated content and calmness while paying attention during math class.

Limitations

The overall research was obviously limited to one target student, but the results prove worthwhile for further discussion, testing, and analysis. Should additional research demonstrate similar outcomes, teachers could intentionally build specific activities into their daily and weekly plans to boost children's attentiveness that have been diagnosed with ADHD. Not only would students with ADHD benefit from such specially-designed intervention techniques, but the teacher and fellow students might also enjoy a classroom that is less disruptive and more conducive to learning.

Another limitation to the study was that the child was on medication for ADHD. It would have been an ideal situation if the target child was not on medication and the intervention still proved to be successful. Because he was on medication, there can be uncertainty whether or not the results were successful solely because of the intervention or only to a certain extent because the child was on medication for ADHD.

Third, a limitation that could have skewed the results might have been the specific math activities that occurred during the three weeks. It seemed if the activity was hands-on and allowed the children to stand up and use different math materials, then the target child would not exhibit the target behaviors as often. If the teacher stood in front of the class and lectured or assigned seat work, then the target child displayed the behaviors more frequently. This pattern of frequency occurred not only during the baseline and post-intervention observation weeks, but during the intervention as well. This may

indicate that being more active during classroom lessons produces a more successful outcome for some students.

The final limitation would be the time-factor. The intervention was successful, but it only lasted for one week. If this continued throughout the year, the chance of it being successful with this particular target child is likely, but cannot be stated definitively because it was limited to a one-week intervention.

Future Research

Future research on this topic might include implementing this intervention for a child who is not on medication. Also, continuing the intervention for a longer period of time would be suggested. There have been some studies involving physical activity as an intervention for children with ADHD, but few have been on children not on medication and as a consistent class-wide approach.

In addition, researchers could identify the child's academic weaknesses and strengths and implement the intervention before each subject in which the child struggles. The researchers would then be able to determine effectiveness of the intervention by examining the child's academic improvement.

Referring back to the 'token economy' idea, if a child enjoys the exercises, as did the target child in this research, the intervention can be used as a reward. If the child demonstrates attentiveness during class, he/she can be rewarded with extra recess time or allowed to go into the hall to do an activity. Future research would assist in determining additional benefits regarding academics and physical activity for children with ADHD.

Implications for Practice

The findings of this study are important for early childhood educators. According to the results of this research, children with ADHD are more attentive in school when they are more physically active. Research shows that physical activities during school hours positively affect children with ADHD's ability to focus.

It is important for teachers to understand that children with ADHD need extra accommodations in the classroom, and in this case and in previous studies, physical activity as an intervention impacts children's on-task behavior. In this study, the child really enjoyed the physical activities and a positive outcome was established.

During this study, each student seemed to enjoy the physical activities and all were able to sit down at their seats afterward and attend to their math teacher. It was evident that the target student not only enjoyed the physical activities, but benefitted from them by reducing the frequency of the target behaviors during math class. The teacher was impressed by his increased ability to focus during the intervention week.

Along with increasing the target child's ability to focus in the classroom, the physical activities seemed to immediately initiate a positive demeanor from the child during the rest of the math period. His energy level was high and he was more willing to ask/answer questions and participate in class. According to Armstrong (1995), "...kids with hyperactivity or aggressive traits may improve their behaviors if they engage in regular vigorous physical education" (p. 87). The target child in this study was frequently off task, and because physical education class does not occur every day for most students, it is important for the teacher to implement extra opportunities for physical activity to better assist this child with ADHD. Armstrong also advocated for movement activities to

be implemented into the regular education classroom to provide channels for the need of appropriate physical movement. In conclusion, physical activity benefits children's personal well-being, and in this case, it could help this target child soar to reach his fullest potential as a student and as a unique individual.

Appendix

Exercise Survey

1. I can pay attention better to the teacher after I do some physical exercises.



2. I get too excited and have trouble paying attention in class after I do physical exercises.



3. Doing physical activities before class helps calm my body down so I can concentrate better and do my school work.



4. Do you like to do physical exercises?



5. Doing physical activities before class makes me tired and I can't pay attention very well.



6. What are some new physical exercises you would like to do before class? *If none, just put "None".*

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