The Effect of HIIT Physical Activity Paths

on

Disruptive Behaviors of Elementary Aged Students

By Ashley N Melefsky

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Abstract

The purpose of this study was to examine the effect of high intensity interval training (HIIT) workout paths on the frequency of disruptive behaviors with elementary-level students. This study was a quasi-experimental, pre/post-test design that included fourteen third graders in a general educational classroom setting. The participants ranged from ages eight to nine. The null hypothesis stated that there would be no difference between the weekly average numbers of disruptive behaviors when using HIIT physical activity paths or not using HIIT based on a comparison of pre-test/post-test data. The HIIT physical activity paths included five different workouts for children to complete at least three times daily before content instruction. The instrument to track data utilized a weekly tracking sheet to record all identified behavior frequencies. The disruptive behaviors were collected through observation during the pre-test and identified as "hands on others, calling out, talking to others, refusal to do work, hyperactivity, and yelling." The null hypothesis was rejected as four of the six behaviors exhibited a downward trend when comparing the pre-data to the final Week 6 data collected during the study. Physical activity can be associated with a decline in disruptive behaviors for Grade 3 classrooms similar to the study group.

CHAPTER I

INTRODUCTION

Overview

Having taught the past five years in elementary school classrooms, the researcher has observed an increase of the impact of disruptive behavior on instruction and independent learning. Disruptive, off-task behavior can interfere with individual student's learning, as well as that of their peers. In this fast-paced 21st century learning environment, it's imperative to decrease the number of disruptive behaviors in the classroom.

Kwon, Kim, and Sheridan (2012), express that behaviors have a strong effect on the academic functioning of children. In order for children to be successful with their learning, they must be able to participate and learn in an environment with less behavioral distractions. According to Ma, Mare, and Gurd (2014), there is evidence that physical activity breaks can improve on-task behaviors. Based on the study they completed, the physical activity can help children gain more focus and can decrease off-task behaviors, which sparked the researcher's interest in utilizing physical movements as breaks to change behaviors.

Statement of Problem

The purpose of the study is to investigate if increasing physical activity, high intensity interval training (HIIT) physical activity paths, in the classroom will decrease behavioral disruptions during independent and instructional time.

Hypothesis

The null hypothesis of this study is that HIIT physical activity paths have no effect on behavioral disruptions in the third-grade classroom.

Operational Definitions

The independent variable is ***the high intensity interval training (HIIT)*** physical activity paths. The researcher will operationally define this independent variable by utilizing a checklist that contains critical instructional steps for the teacher to use when implanting the physical activity path with students. There is no control group; all students included in the study will complete the HIIT physical activity paths.

The dependent variable is a ***weekly tracking sheet*** for disruptive behaviors for these participants. The researcher will operationally define this dependent variable by calculating the number of disruptive behaviors per week for each child that is collected in the 8-week period during this intervention. This study is quasi-experimental since there is no control group and no random assignment of participants. The number of disruptive behaviors will be determined prior to and post intervention.

CHAPTER II

REVIEW OF THE LITERATURE

Overview

This literature review focuses on behavioral disruptions in the elementary school classroom. The way that a child behaves affects their learning each day. Researchers have found that 58% of devoted classroom instructional time is lost due to behavior problems (Benner, Kutash, Nelson, & Fisher, 2013). Section one provides the possible impact of behavior disruptions on learning, which includes common causes of disruptions. Section two includes descriptions and explanations of the three different tiered levels of interventions for addressing problematic behaviors. Section three discusses different types of interventions that can reduce behavioral disruptions. The overarching problem that is examined throughout this literature review is how to reduce behavioral disruptions in third grade classrooms during instructional and independent work.

Impact of Behavioral Disruptions on Learning

Types and Common Causes of Disruptions

Behavioral disruptions in the classroom can vary from minimal disruptions interfering with only the child's learning, to extreme disruptions interfering with the instruction for the entire classroom. Adhikari, Upadhaya, Gurung, Luitel, Burkey, Kohort, and Jordans (2015) express that the five most frequently reported behavior problems are not paying to attention to studies, involvement in addictive behaviors, getting angry easily and fighting over small issues, disobedience, and stealing. These behaviors could be interrelated and interdependent. Each child who exhibits such disruptive behaviors may do so for different personal, emotional, or social reasons. Teachers, parents, and counselors can readily identify what type of behavioral

disruption a child is exhibiting in the classroom, but the challenging task is to discover why the child is behaving a certain way in order to be able to improve the behavior.

There are many different reasons why children behave different ways that may cause disruptions to themselves, others, and their learning. Students can display behaviors that impact classroom learning due to their life at home or issues in their community. Furthermore, behavior can be linked to family issues at home. A study that was completed to identify perceived behavioral problems of school-aged children showed that community members view the family, community, and school environment as being the causes of the child's behavioral problems. If there are issues at home or issues in the community that affect children, it can change their behavior in different aspects of their life, such as at school. Additionally, children can develop behavioral issues at school due to underlying problems occurring in the classroom.

Some behavioral disruptions are due to medical issues or learning disabilities. Adhikari et al., (2015) explains that behavior problems which include problems related to repeated violation of others' rights, aggression, hyperkinetic impulsive behavior, and missing class/running away can be a sign of a learning disability for children who range from 5-19 years old. Furthermore, this study concluded that 10.5% of adolescents suffer from mental health problems, with a significant proportion of those being conduct problems. These medical conditions contribute to common behavioral/conduct issues in the classrooms. They affect children medically, but also socially in the classroom.

Attention Deficit Hyperactivity Disorder (ADHD) is an additional learning disability that can create behavioral disruptions in the classroom. ADHD is a learning disability that interferes with a person's learning due to difficulty focusing their attention, which can sometimes be due to their own hyperactivity. There are multiple types of ADHD that can yield different types of

behaviors in the classroom, which can affect learning and social skills with other students

Additionally, in a study focused on the academic and social impairments of children with ADHD, researchers have discovered that there is a relationship between lower academic performance and lower social functioning for children with ADHD, compared to other referred children without ADHD and controls (McConaughy, Volpe, Antshel, Gordon, & Eiraldi, 2011). Students with ADHD can exhibit lower social functioning that impacts learning in the classroom for themselves or others. These researchers reported that children with ADHD-Combined type tend to be more aggressive, while children with ADHD-Predominantly Inattentive type tend to be more passive and inattentive. These two types of ADHD and other mental illnesses are causes of behavioral disruptions in the classroom.

Effects on Learning

There are many causes for negative behaviors, but all of them negatively affect learning. Behavioral disruptions can affect the child who is exhibiting the behavior, as well as students surrounding them in the classroom. Any disruption in the classroom can impair the learning of multiple students, which can affect their grades as well. In a study created by Kwon et al., (2012), students' behavioral competence was found to contribute to all aspects of academic functioning, such as reading and math achievement, and academic problems. Additionally, the process of teacher instruction followed by disruptive behavior has created avoidance behaviors by teachers, because they have begun to either choose to remove the child with disruptive behavior from the classroom or choose not to ask the child to complete the academic tasks (Benner, et al., 2013). This creates a decrease in effective teaching and learning in classrooms with behavioral disruptions.

Students with learning disabilities who also exhibit behavioral disruptions have a correlation to lower standardized testing scores. According to McConaughy et al., (2011), children with ADHD, who also often have behavioral disruptions, such as inattentiveness or aggressiveness in the classroom, have scored significantly lower than controls on the standardized tests of reading/language, mathematics, and written language. There was a correlation between their lower test scores and their behavioral issues. Professional studies and authors of scholarly journals show concern for behavioral symptoms and their effects on academic performance. These researchers stated that the study's results suggested that children with ADHD require interventions that directly target academic performance and social functioning to reduce core symptoms, including behavioral symptoms, of the learning disability. This makes sense as these negative effects on learning can have a long-lasting effect on their cognitive development.

Descriptions of Different Tiered Levels of Interventions

There are three tiered levels of interventions for behaviors in the classroom. According to Yong and Cheney (2013), tiered interventions follow a multitier RTI (response to interventions) model that can be utilized to create an action for disruptive behaviors. When focusing on behavior, a tier 1 intervention is a school-wide positive behavior system that is implemented for most students. Tier 2 interventions focuses on a targeted support, such as daily report cards for students who do not respond to the tier 1 intervention. Tier 3 interventions are individualized supports, such as function-based behavior plans. Actual interventions can vary depending on the children involved and are based on what they need. The goal of the multi-tiered levels of interventions is to have effective actions at lower tiers, which will result in less students needing more intensive tiered supports. Furthermore, tier 2 interventions are more focused on a set of

students and are common interventions that are created to reduce behavior. According to these researchers, tier 2 interventions are implemented for about 10%-15% of the school's population of students. This level of intervention is something that is quickly accessible when tier 1 interventions are not working. Additionally, tier 2 interventions are still consistent with school-wide expectations and students' progress is monitored regularly. Each of these tiered interventions' goals is to ultimately reduce the targeted area, which would be behavior.

All types of the tiered interventions have been proven to be helpful to students in terms of reducing behavioral issues. Tier 2 interventions target students with behavioral disruptions who are not responding to more basic tier 1 interventions. In addition, it helps the child decrease the behavior or cease the escalation of the negative behavior that is being exhibited (Yong & Cheney, 2013). During tier 2 interventions, teacher and family involvement are likely to contribute to the maintenance of positive behavior skills. For example, a check in/check out chart that includes rewards at school and at home may help include family involvement and support. Children need the teacher and family to provide the regularity of this intervention for it to be successful. Many tier 2 interventions have been utilized and studied to decrease behavioral disruptions.

The following section reviews several common interventions that have been applied to reduce disruptions.

<div align="center">**Behavior Interventions That Could Reduce Disruptions**</div>

Modifications to Classroom Environment

An intervention that has been researched and studied to reduce behavior is modifications to the classroom environment. The environment can be the physical space which is a classroom, or the social environment between peers and staff in a classroom. According to Guardino and Fullerton (2010), a well-organized classroom permits positive interactions between teachers and children, which reduces the chance of challenging behaviors. Modifying the classroom environment can be an intervention for students with challenging behaviors. There are some quick and easy changes to the environment that can be done to help decrease disruptive behaviors. According to these researchers some of the most popular classroom modifications that can have positive impacts on behavior include changing seating arrangements, creating a group space, adding organizational materials, or providing engaging lessons to keep students busy.

Besides the physical environment, teachers can employ other specific strategies into the classroom to help decrease behavioral disruptions. These strategies are intended to be used with the whole class instead of just the targeted students. According to Duchaine, Green, and Jolivette (2010), response cards have been studied for more than 35 years and have increased engagement and learning. Response cards are an intervention that can help keep students on task, which will keep them from creating disruptive behavior by all students responding to each problem. Therefore, the teacher can be more aware of each student and their progress throughout the lesson. Another successful intervention that effects the entire class focuses on a class-wide function-related intervention team (CW-FIT). According to Naylor, Kamps, and Wills (2018), the CW-FIT intervention involves teaching specific behavioral skills that can increase the desired positive behavior, increasing teacher attention to the positive behavior, and reinforcing

behavioral skills through a points system within a group format. This intervention can be adapted to any classroom that has behavioral disruptions and can benefit multiple students, if not the whole class and teachers as well. These researchers explain that the CW-FIT resulted in a reduction in disruptive behavior for each of the three targeted students that were studied and an increase in on-task behavior for the class and students. This intervention focuses on changing the mindset of the classroom environment.

Increase in Physical Activity

Another intervention that has appeared successful to help reduce behaviors in the classroom is increasing physical activity. Ma et al., (2014) completed a study examining the effects of brief, high-intensity interval exercise on off-task behaviors in the classroom. The students that were involved in the study were either exposed to no activity breaks or an activity break of 4 minutes that was considered "high intensity". Results from this study showed that very brief high-intensity bouts of exercise can improve off-task behavior in second and fourth graders. Students can take their energy and participate in a high-intensity interval exercise, which may decrease the behavior. An additional benefit is that evidence suggests that acute bouts of physical activity can improve cognitive function, concentration, and academic achievement. This intervention of including physical movement into the classroom may help academically, as well as reducing behaviors. After students have completed the bout of physical activity, they are more focused and ready to learn in the classroom.

Another study was completed that involved physical activity and on-task behavior. Stoepker, Dauenhauer, and McCall (2018) studied the different effects of a walking activity and the ability to stay on task. They found that when children are not exposed to enough activity throughout the day, they are more likely to be off task and fidgety. This is when the disruptive

behaviors can begin that will affect the child and their surrounding peers. This study included a 20-minute brisk walk in which the children listened to a kid-friendly podcast that included academic content. Providing the students with a break that includes physical activity and something academic to listen to helps them to feel recharged while also continuing to be educated. According to the results, on task behavior increased by 7.5 % and the participating students had fun learning while exercising. Both studies expose the benefits of including physical activities into behavioral interventions for students. Students' undesirable behaviors decreased, they received exercise, and their academics increased.

Check In/Check Out System

A final intervention that has been successful for reducing disruptive behaviors at school is a check in/check out system. These are tier 2 interventions since they are designed to provide a more targeted intervention than tier 1 and can be applied to multiple students (Swoszowski, McDaniel, Joliverte, & Melius, 2013). These researchers explained that a check in/check out system provides daily, scheduled, positive feedback between a student and mentor. It focuses on setting behavioral performance and goals. The check-in/check-out system involves a meaningful relationship with someone whom the child trusts and will be motivated to please. This creates motivation for positive behaviors for the targeted students. These students are required to check in and out with their mentor each day, sometimes more than twice to evaluate how they are doing with the behaviors and goals that they set for the day. By checking in and evaluating how they are doing, the children are taking the time to be reflective with adult support. This intervention provides them with time to think more clearly about the behaviors that they are exhibiting and how the behaviors can affect themselves and others. The study results show that all four students who were exposed to this intervention responded positively with decreased off-task behavior.

Another study involving a check in/check out intervention focused on the mediation effect of the daily progress report and moderation effects of relationships between mentor and student. In this study, Stage and Galanti (2017) analyzed the effects of a tier 2 intervention, check, connect, and expect system, to reduce disruptive behaviors. They found that the difference between students who demonstrated more positive behaviors than others were the students who had a positive relationship with their teacher. Teachers build relationships with students at the beginning of the year and try to maintain them throughout the school year. These can be impacted by disruptive behaviors. This study reinforces that positive relationships between the student and teacher are critical for a check in/check out system to be successful and decrease any unwanted behavior in the classroom.

Summary

This literature review addresses the problem of disruptive behaviors in elementary schools. Understanding the common types and causes of behavioral disruptions and the effects they can have on learning is essential in reducing behavioral disruptions in the classroom. Behavioral disruptions can affect the students with the behavioral issues and other students' learning in the classroom, as well as student-teacher relationships. The use of effective behavioral interventions can reduce the amount of distractions during independent and instructional time, as well as increase academic achievement and social functioning for students.

The studies discussed in this literature review support the idea that behavioral disruptions negatively impact learning in the classroom environment. Furthermore, they support the use of tiered level interventions to be implemented in the classrooms for students with behavioral disruptions. The findings in this literature review recognize different interventions such as modifying the classroom environment, increasing physical activity in students, and check

in/check out systems and show a positive impact for the identified students with behavioral

issues in the classroom setting based on their use.

CHAPTER III

METHODS

This study was conducted in order to determine whether using HITT physical activity paths impacted the number of disruptive behaviors displayed by third grade students in a general education classroom throughout the school day.

Design

This study was based on a quasi-experimental, pre/post-test design to determine the impact of how HIIT physical activity paths had on decreasing behavioral disruptions during independent and instructional time. The dependent variable in this study was the type of disruptive behavior and how many times the behavior occurred throughout the week. The dependent variable was measured using a tracking sheet that was completed by the instructor, which identified the types and frequencies of disruptive behavior. The tracking sheet contained the dates for the week; the type of disruptive behavior, and how many times the intervention was applied.

The independent variable was the HIIT physical activity paths which addressed the disruptive behaviors. The activity paths include jumping jacks, wall push-ups, jumping rope, cheetah runs, and mountain climbers. These activities were for ten seconds each; with a ten second break in between each. The participants were required to repeat these activities four times each or more, if necessary, totaling to about five to seven minutes for the entire intervention. The teacher taught each of the activities to the students either in their Physical Education classes or in the general education classroom. There was also a visual posted of each physical activity on the wall. The teacher administered the independent variable over the period of six weeks to fourteen students in a third-grade class setting.

Participants

The participants in this research were fourteen Grade 3 students in a Baltimore Public County School. This convenience sample was composed of students with behavioral disruptions that required redirections, stop and think, and students who were required to go to "buddy rooms" for disruptive behaviors. The sample contained two females and twelve males. Eight students (57%) in this sample were African American, three students (21%) were Caucasian, and three students (21%) were other races. Nine students in the study were eight years old and five students were nine years old. Five of the students had an Individualized Education Plan (IEP) for learning disabilities, which were either identified as Attention Deficit Disorder (ADD), Attention Deficit Hyperactivity Disorder (ADHD), or a Learning Disorder. There was no comparison or control group of similar students available for this action research study.

Instrument

The instruments used were weekly tracking sheets to record the frequency of behaviors that disrupted learning and the lists of HIIT physical activity paths with directions. The weekly tracking sheet was teacher-made, and a copy is located in the Appendix. The tracking sheet allowed the teacher to tally how many disruptive behaviors occurred each week for each child, and the type of disruptive behavior.

The HIIT physical activity paths were selected as the independent variable, or input, of this study to decrease the amount of disruptive behaviors throughout instruction and independent learning. The physical activity paths are short high intensity physical movements for children to complete to help them burn off some energy, regain focus, and stop disruptive behaviors from escalating or occurring. The physical activity paths could be used daily before long periods of instruction, independent work time, or whenever necessary. For instance, the teacher could

utilize this intervention if they observed a student displaying a disruptive behavior, or if they observed the precedent signs of a disruptive behavior that may develop. When the children were first learning to complete the physical activity paths, it was important for the teacher to supervise the children closely so that they could be successful in completing each physical activity throughout each use of the intervention.

Procedure

To begin this study, the teacher observed students during instruction and independent work throughout each content area for one week before the intervention. The observations took place during whole group Word Work, Reading, and Math. Additionally, the observations took place during independent learning, which consisted of seatwork, device work, or partner work. The teacher did not inform the participants that they were being observed. During the observation, the teacher used the weekly tracking sheet to tally the frequency and types of disruptive behaviors that violated classroom rules that have been in place since the beginning of the school year, which was four and a half months.

Once the teacher established the rules and explained the HIIT physical activity paths to the students, the teacher continued to observe the targeted behaviors that were originally identified from the baseline week. The teacher tallied the number of targeted disruptive behaviors per week for each child. The teacher utilized the pre-test data as the baseline of comparison throughout the six-week study.

The teacher observed that the students received the most positive behavioral report as a class when they were completing intense physical activities in Physical Education. Based on the research completed for the literature review, the teacher decided to study how high intensity physical activities affect children's classroom disruptions. The teacher chose the physical

activities of jumping jacks, wall push-ups, jumping rope, cheetah runs, and mountain climbers. The teacher modeled each of the physical activities and provided a timer for the students if they needed to complete the intervention separately from the class. The teacher and students discussed different reasons why they would need to use the physical activity paths and constructed a list to refer to throughout the study. The students had visuals for each of the physical activities posted in the classroom and hallway so that it was visible for every child participating in the study.

The teacher monitored and recorded the disruptive behaviors for each child per week for six weeks, which consisted of the same class schedule and similar independent tasks as the baseline week. The teacher completed the HIIT physical activity paths three times daily with the participants; one during each content block (Word Work, Reading, and Math). Throughout the study, children were encouraged to utilize the intervention whenever they felt necessary based on the list the class had made together. Furthermore, the teacher recorded how many times each child participated in the HIIT physical activity paths each week.

<div align="center">**Analysis Plan**</div>

Null Hypothesis: There is no difference between the weekly average numbers of disruptive behaviors when using HIIT physical activity paths or not using HIIT based on a comparison of pre-test/post-test data.

The one-group *t*-test (dependent *t*-test) was used to determine if a statistically significant change occurred in the number of disruptive behaviors of adjacent weeks, as well as between the pre-study and post-study. The customary alpha level of 0.05 was applied to the sample weekly differences and the pre-post difference. That is, the researcher was willing to take at most a 5% chance that rejecting the null hypothesis was a Type I error (false positive).

In addition, Cohen's d was calculated to estimate the effect size of the difference because of the small sample size. The effect size measures the direct impact of the treatment regardless of sample size (Cohen, 1992). Statistical significance may go undetected in small samples, yet the treatment effect may still be important and of practical value. The pattern of disruptive behaviors was modeled with the best-fitting time series curve (Minitab 2016).
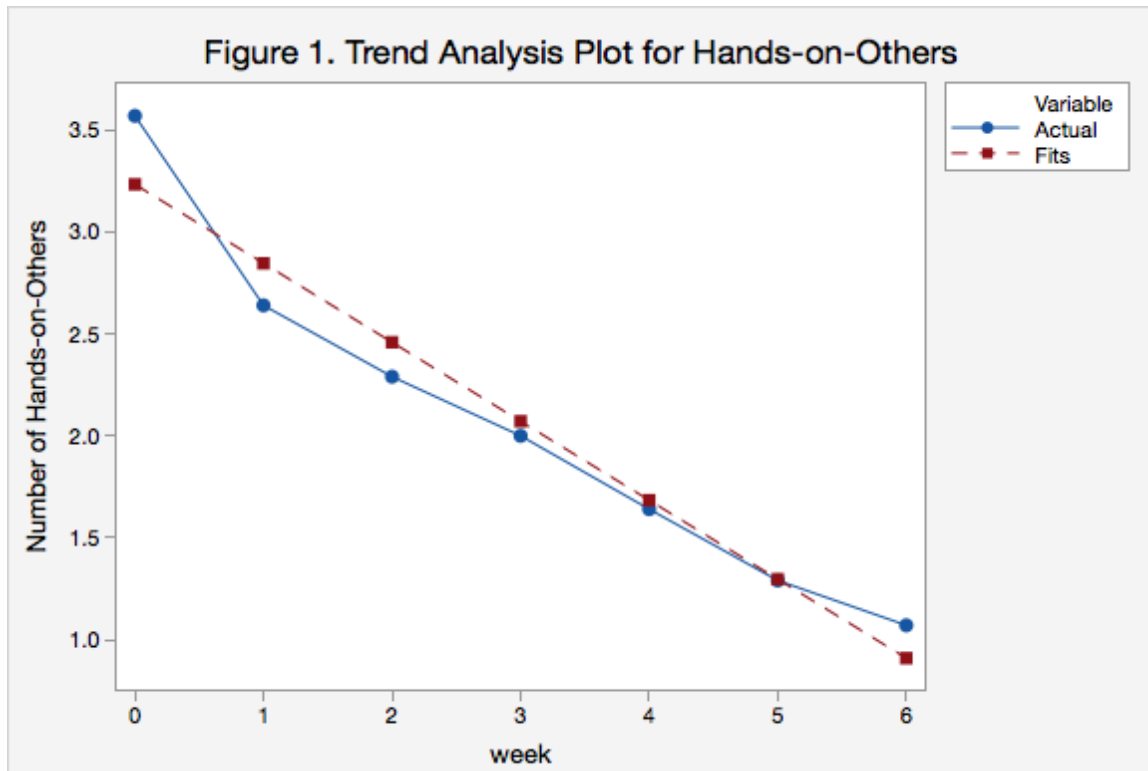
CHAPTER IV

RESULTS

Introduction

This study examined how utilizing HIIT physical activity paths decrease the number of disruptive behaviors of students in a third-grade general education classroom during the school day. A researcher modeled the physical activity paths and created posters with visuals for children to reference throughout the day.

The data was collected during a pre-week and for six consecutive weeks of treatment thereafter. The final post-treatment disruptive behavior counts were unable to be taken. The independent (treatment) variable was physical activity measured by the number of workouts per week from Week 1 through Week 6 by the 14 subjects in the study. The workout consisted of the following activities: jumping jacks, cheetah running, mountain climbers, push-ups or wall push-ups, and jumping rope. Each of these workouts was for 10 seconds and was followed by a 10 second break between each. The students would complete the workout activities four times. The general educator completed the physical activity workouts with the students three times each day before the content areas of Word Work, Math, and Reading. The students were also allowed to utilize the physical activity paths throughout the day when needed. The dependent (outcome) variable was the weekly number of disruptive behaviors observed by the researcher during the school day from 10:00-3:00, 5 days a week. The disruptive behaviors included hands-on-others, calling-out, talking-to-others, refusing to work, hyperactivity, and yelling.

The following data displays present the weekly time series trends using the mean number of disruptive behaviors from pre-week through treatment weeks 1-6. The graphs show the actual number of disruptive behaviors and the predicted number using the trend analysis (Minitab,

2016). According to the graphs, the mean number of weekly disruptive behaviors generally

trended downward from the pre-treatment week through the subsequent six weeks of treatment.

Furthermore, the most notable exception was the disruptive behavior, "Calling Out," which

trended down from week 1 through week 5 but had an uptick in week 6.

Figure 1. Trend Analysis Plot for Hands-on-Others

Figure 2. Trend Analysis Plot for Calling Out
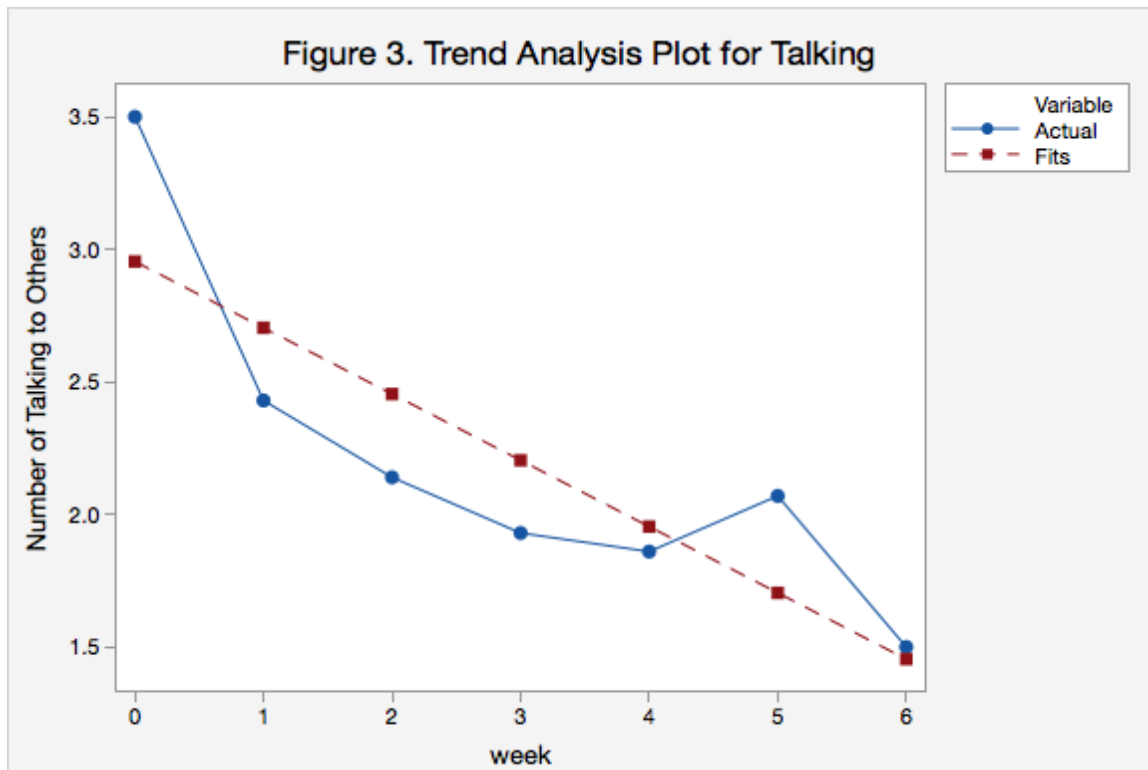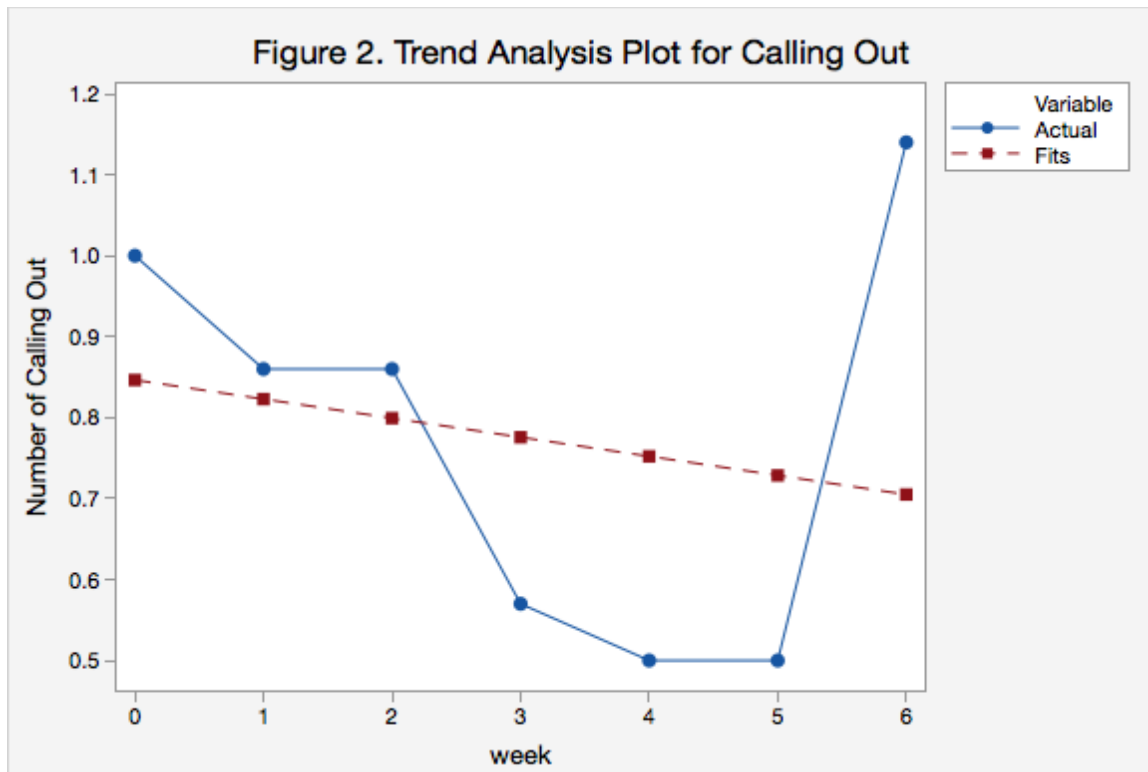

Figure 3. Trend Analysis Plot for Talking

Figure 4. Trend Analysis Plot for Refusing to Work
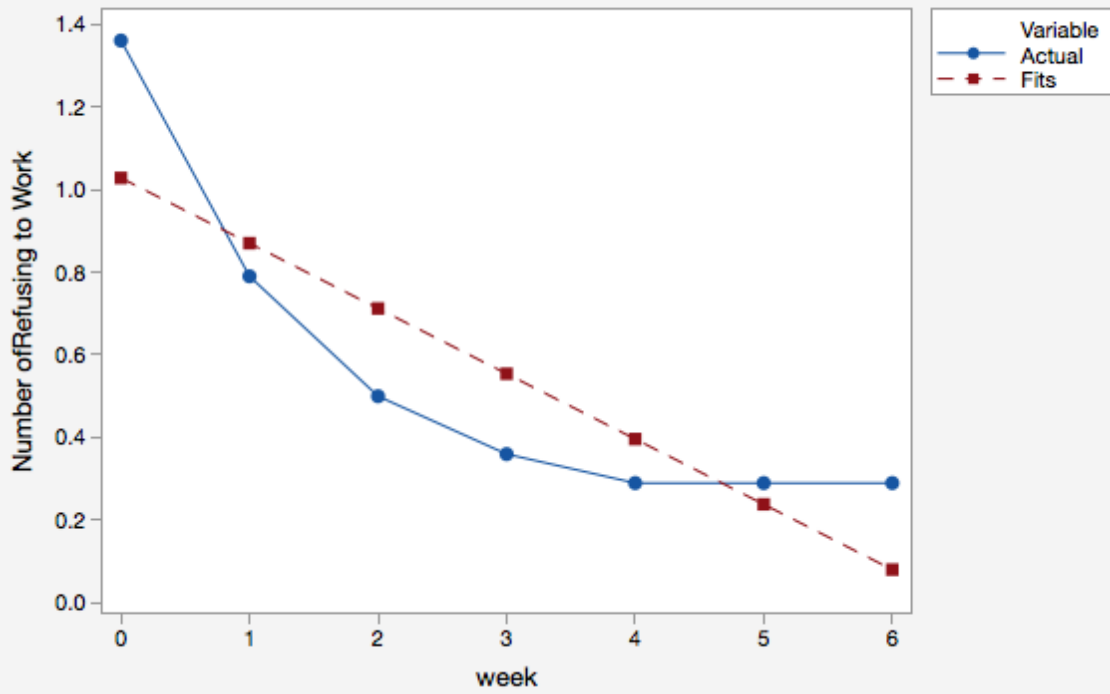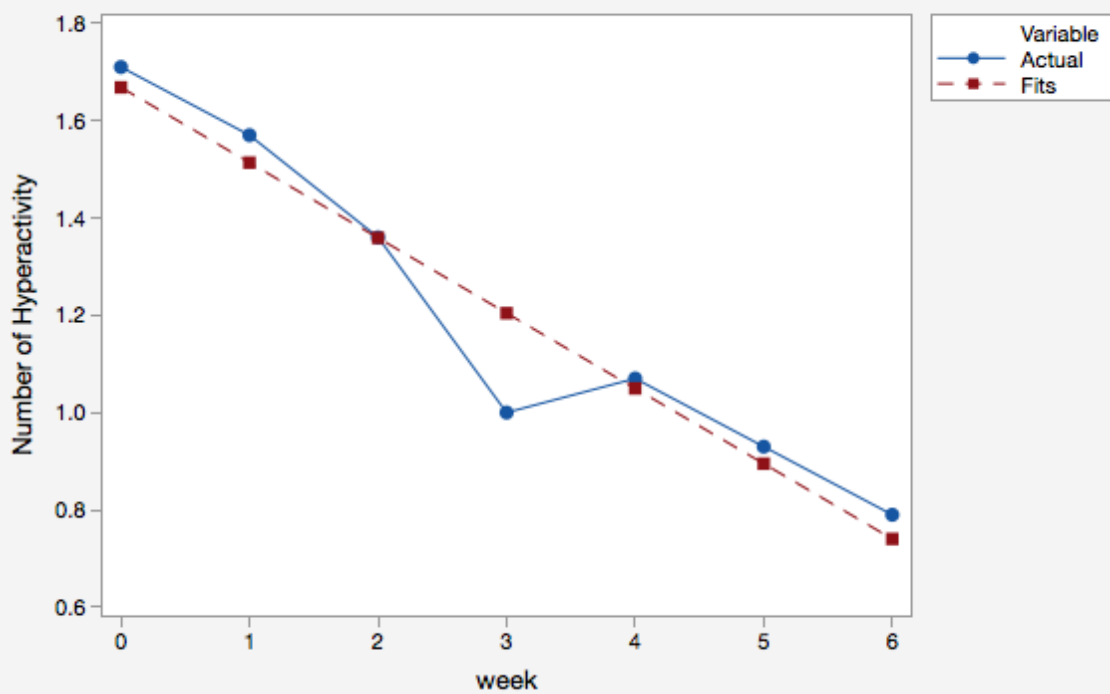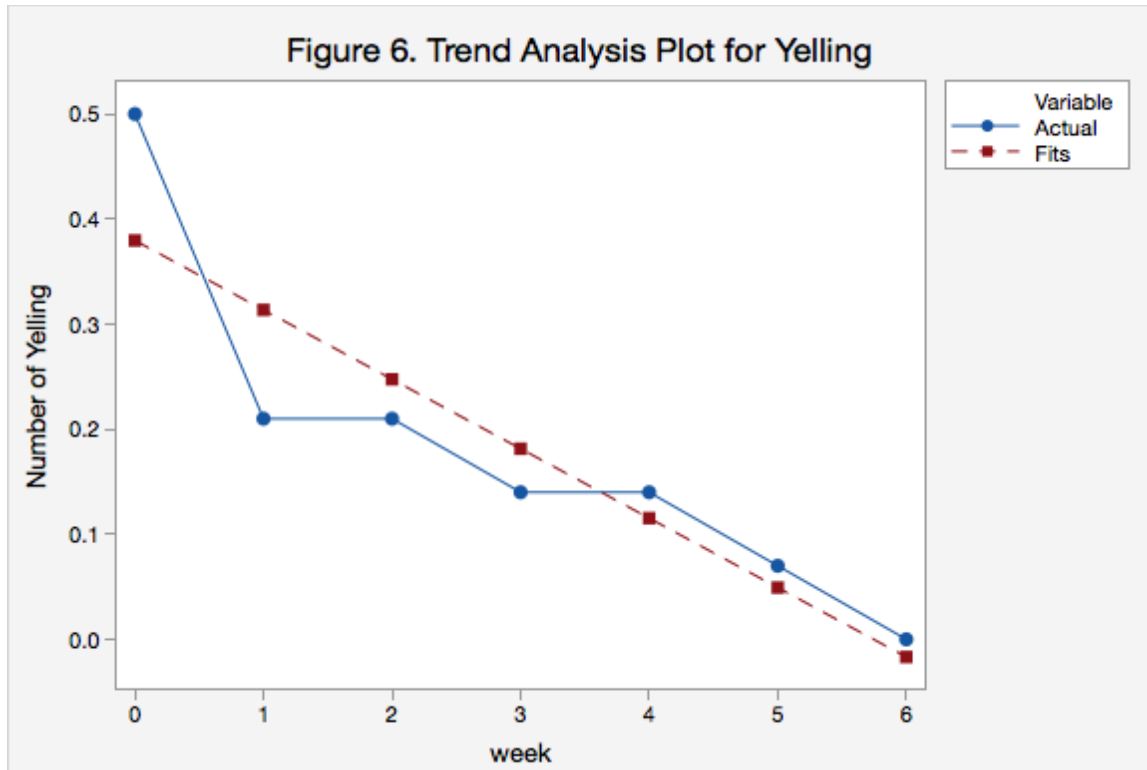

Figure 5. Trend Analysis Plot for Hyperactivity

Figure 6. Trend Analysis Plot for Yelling

In the tables below, are the weekly mean numbers of disruptive behaviors (Table 1) and the mean number of workouts (Table 2) for the 6 weeks. Table 3 shows the Pearson correlations among treatment and output variables. The mean number of workouts during the treatment weeks 1-6 varied, although the overall trend was slightly down (see Table 4 and Figure 7).

Table 1.
Weekly Mean Number of Disruptive Behaviors and Number of Workouts

Week	Hands	Call-out	Talking	Not Work	Hyper	Yell	Workout
Pre	3.57	1.00	3.50	1.36	1.71	0.50	0.00
Wk1	2.64	0.86	2.43	0.79	1.57	0.21	14.43
Wk2	2.29	0.86	2.14	0.50	1.36	0.21	14.79
Wk3	2.00	0.57	1.93	0.36	1.00	0.14	14.79
Wk4	1.64	0.50	1.86	0.29	1.07	0.14	14.00
Wk5	1.29	0.50	2.07	0.29	0.93	0.07	13.79
Wk6	1.07	1.14	1.50	0.29	0.79	0.00	14.71

Table 1A.
Mean Change in Disruptive Behavior Pre-Week vs. Week 6

Behavior	Paired t-test	p-value	Which Hypothesis
Hands-on-others	3.83	.002	Alternative
Calls-Out	1.39	.18	Not reject Null
Talking-to-others	2.94	.01	Alternative
Will not work	1.99	.06	Alternative
Hyperactivity	2.12	.05	Alternative
Yelling out	1.34	.20	Not reject null

In table 1A, the number of disruptive behaviors was compared for the pre-treatment week and the final treatment, Week 6. Since the same students were studied each week, the dependent or paired t-test is used to determine whether the sample mean differences would likely occur in other similar classrooms. The alpha level is set to the more liberal 10% because the sample is small. That is the chance of a false positive if the null is rejected is at most 10%.

If the alternative is chosen, the p-value was at most 10% and the null was rejected. This indicates the reduction in disruptive behaviors was sufficient to reject the null of no treatment effect.

The behaviors, hands-on-others, talking-to-others, will not work, and hyperactivity, decreased enough to reject the null hypothesis, alpha=.10. The behaviors, calls-out and yelling out, declined but not enough to reject the null. With small samples, the risk of not detecting a true treatment effect increases. That is a possible reason why the sample data showed a treatment effect, but the sample results did not generalize to the population of other similar classrooms.

Table 1B.
Repeated Measures ANOVA for Disruptive Behaviors

Behavior	F (6,78)	p-value (H-F)	Decision	Effect Size
Hands-on others	**10.22**	**0.001**	**Alternative**	.40, small
Calling out	0.75	0.49	Cannot reject null	.00, none
Talking to others	**4.48**	**0.001**	**Alternative**	.20, very small
Won't do work	**3.11**	**0.07**	**Alternative**	.13, very small
Hyperactivity	**3.16**	**0.07**	**Alternative**	.13, very small
Yelling	1.70	0.21	Cannot reject null	.05, very small

p-value is Huynh-Feldt epsilon correction for repeated measures.
Alpha was set at 10% due to small sample size.
Effect Size = Omega Square for ANOVA.

Table 1C. Comparing Pre-Week with Subsequent Treatment Weeks

Behavior	Week1	Week2	Week3	Week4	Week5	Week6
Hands on others	Null	Alt	Alt	Alt	Alt	Alt
Calling out	Null	Null	Null	Null	Null	Null
Talking to others	Null	Alt	Alt	Alt	Alt	Alt
Won't do work	Null	Null	Null	Alt	Alt	Alt
Hyperactivity	Null	Null	Null	Null	Null	Alt
Yelling	Null	Null	Null	Null	Null	Null

"Null" = insufficient evidence to reject null hypothesis of no population mean difference.
"Alt" = sufficient evidence to reject null in favor of alternative hypothesis with Bonferroni adjustment for multiple comparisons.

Based on Table 1B and 1C, repeated measures ANOVA tests for population mean differences based on sample observations. There is one sample of 14 students whose disruptive behaviors were counted for one-week pre-treatment followed by six weeks treatment. These students participated in the study each week. The null hypothesis (Recorded as "Null" in tables above) says there is no difference in population means across the pre-treatment week through 6 weeks of treatment. The alternative hypothesis (Recorded as "Alt and Alternative" in the tables above) says at least one population mean is different from the others. The alpha level for rejecting the null hypothesis was set at 0.10, since the sample size is small. Rejecting the repeated measures null is analogous to identifying a non-zero slope for the population trend. The results of the repeated measures ANOVA confirmed analytically the visualization of the linear trends in Figures 1-6.

Table 2.

Mean Weekly Number of Workouts After Pre-Week.

Treatment Week	Number Workouts
1	14.4
2	14.8
3	14.8
4	14.0
5	13.8
6	14.7

Table 3.

Pearson Correlations Among Treatment and Output Variables

```
              week    hands call_out talking   not_do   hyper     yell

    week    1.0000
   hands   -0.9751*  1.0000
call_out   -0.1993   0.2939   1.0000
 talking   -0.8466*  0.9235*  0.2414   1.0000
  not_do   -0.8548*  0.9386*  0.4668   0.9604*  1.0000
   hyper   -0.9641*  0.9534*  0.3034   0.8736*  0.8951*  1.0000
    yell   -0.8971*  0.9634*  0.2495   0.9618*  0.9407*  0.8941*  1.0000
 workout    0.5939  -0.7521  -0.3443  -0.8981* -0.8798* -0.6336  -0.8749*
```

Table 4.

Time Series Trend Statistics for Weekly Disruptive Behaviors

Behavior (Y)	Trend Equation	Accuracy		
		MAPE	MAD	MSD
Hands-on-Others	Y=3.62-0.39*t	6.63	0.14	0.03
Calling Out	Y=0.87-0.02*t	28.16	0.20	0.05
Talking to Others	Y=3.20-0.25*t	11.65	0.27	0.10
Refuse to Work	Y=1.12-0.16*t	36.79	0.17	0.04
Hyperactivity	Y=1.82-0.15*t	5.50	0.06	0.01
Yelling	Y=0.45-0.07*t	28.01	0.05	0.00
Workouts	Y=14.66-0.07*t	2.48	0.36	0.14

MAPE=Mean Absolute Percent Error
MAD=Mean Absolute Deviation
MSD=Mean Square Deviation

According to Table 4, the measures of accuracy, particularly MAD, indicate that the closest fits of trend to actual numbers of disruptive behaviors were yelling, hyperactivity, hands-on-others, and refusing to work.

Figure 7. Trend Analysis Plot for Workouts
Weeks 1-6 During Treatment
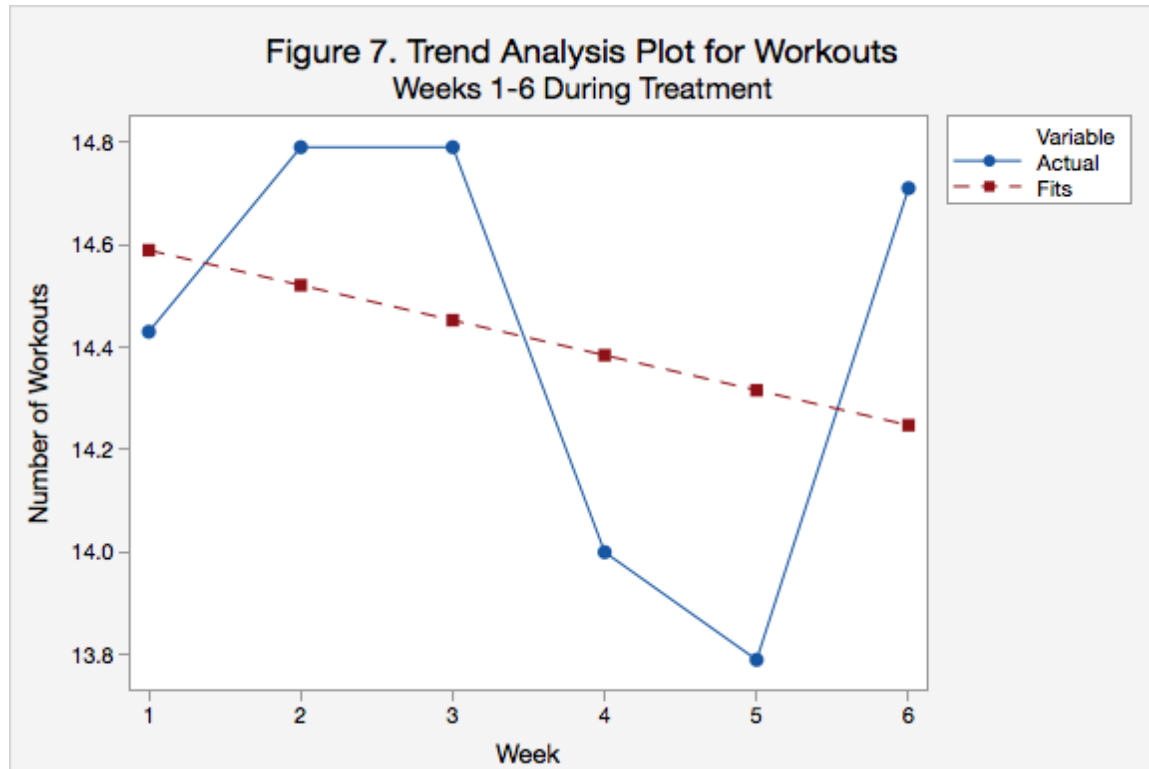
Consequently, the null hypothesis that states, there is no difference between the weekly average numbers of disruptive behaviors when using HIIT physical activity paths or not using HIIT based on a comparison of pre-test/post-test data, was rejected. Under the null hypothesis, the trend across the weeks would be flat with a zero slope. The actual trends for the disruptive behaviors indicated decreasing occurrences. Additionally, it's worth noting that overall each of the different types of disruptive behaviors decreased; although, two students disruptive behaviors increased as their number of workouts throughout the 6 weeks decreased.

CHAPTER V

DISCUSSION

The purpose of this research was to determine the impact of HIIT workout paths on disruptive behaviors in the elementary classroom. The null hypothesis was that there would be no difference between the weekly average numbers of disruptive behaviors when using HIIT physical activity paths based on a comparison of pre-test/post-test data. Four of the identified six behaviors had a downward trend when comparing the pre-week data to the final Week 6 data. The null hypothesis was rejected, because the study found that mean disruptive behaviors declined from 4 (rounded to whole counts) at pre-week data to 1 at the end of 6 weeks.

Implications of the Results

The results were statistically and practically significant since there was a decrease in hyperactivity, yelling, hands on others, and refusal to do work after applying the intervention. The null hypothesis predicted that the slope of the trend line across Weeks 1 to 6 would be zero (flat line). Over the six weeks, however, the number of disruptive behaviors trended downward; there was one disruptive behavior that had an increase the last week, which was "Calling out." During the study, there were two students who began to refuse to participate in the workout paths throughout the school. Additionally, there is a relationship that should be noted; as two students' number of workouts per week decreased, their number of disruptive behaviors increased. Moreover, there were multiple participants in this study who missed the intervention occasionally due to being pulled out of the classroom for services or due to absences. Finally, throughout the study, the research observed that the students were very engaged in completing the workout pathways. Many of the students repeated the workouts at least 2-4 times during their workout break. The students were extremely engaged during the wall push-ups and cheetah run

in place. It should be noted that these two workouts were utilized the most for any future research utilizing this study.

Theoretical Consequences

This study provided further support towards the concept of physical activity helping decrease disruptive behaviors in the classroom. Stoepker et al., (2018), explained that a sedentary lifestyle influences cognitive and brain health that can lead to students being more likely to be off-task and fidgety. Based on the results of this research, as students were participating in the workouts, there was a visible decrease in students being off task and less hyperactive. Furthermore, there was a notable decrease of disruptive behavior from students who would choose to complete the workouts besides the three mandatory times throughout the day. The data showed that students who participated in workouts greater than the 15 mandatory ones each week decreased their disruptive behaviors by the end of the study. The study exemplified Stoepker's findings about the importance of adding physical activity to children's lifestyles. All but 2 of the 14 participants were engaged and completed at least 15 workouts throughout the week. The students that completed more than 15 workouts each week solidify the idea that children want and need more physical activity to stay engaged and on-task.

Threats to Validity

There are a few threats to validity that should be considered regarding this study. First, the sample size was small with only 14 participants. Since this is a small sample size, this could impact the data collected, because if only a few student's behavior improved or decreased, it would influence data. Additionally, there is a threat to validity as the researcher designed the study, collected the data, and used participants from her own classroom. This could possibly

possess some unconscious bias during the data collection period since the researcher knew the participants. Furthermore, there was a lack of a control group, which results in no comparison data between intervention participants and non-intervention participants. Finally, due to the national pandemic, the researcher was unable to complete the post data as schools were closed. This final post week could have either supported the 6 weeks' worth of data for the study or altered the results in a different way.

<div align="center">**Connections to Previous Studies/Existing Literature**</div>

The literature review indicated that students' disruptive behavior could lead to academic issues and impact multiple children in the classroom setting. Though there are many different interventions for classroom teachers to utilize and attempt, adding physical movement into children's daily life has proven to be beneficial for student's behavior, academic performance, and even a healthier lifestyle. The results of this study confirm that the workout paths created overall decreased different types of disruptive behaviors in the classroom. Ma, et. al., (2014) agreed that brief, high-intensity interval exercise can decrease off-task behavior in the classroom. The five workouts that the current study incorporated were all considered "high-intensity" and students did each of the workouts for 10 seconds each, with an option of repeating the circuit up to 3 more times, making the workout paths brief.

Additionally, Ma, et. al., (2014) explained that small bouts of physical activity can improve concentration. Throughout the study, the researcher observed a disruptive behavior to students and their peers, which was hyperactivity. After students applied the intervention of the HIIT workouts, the disruptive behavior, hyperactivity, decreased overall throughout the 6-week span. This additional study supports the idea that small workouts or small amounts of high intensity physical activity can help a person to improve their concentration.

On the other hand, the study the researcher had conducted using these HIIT workouts showed that two students who had some of the more disruptive data either increased in disruptive behaviors or stayed the same throughout the process. Ma, et. al., (2014) expressed in their research that students demonstrating the highest off-task behavior demonstrated greater improvements in behavior after their intervention. This is a difference in these two studies. It's important to note that this could be due to many different variables such as home situations, classroom environments, researchers, and even the types of workouts the children were asked to do.

Implications for Future Research

There are many implications to consider for future research on the topic of this study. For instance, the sample size, duration of the study, the researcher, and a control group should be considered. Future research should consider identifying a larger sample size, which can accurately portray even more significant data findings. This study focused only on third grade students from one school. Moreover, the study could observe multiple grade levels in elementary schools, and even middle and high school students to determine if HIIT workout paths effectively decrease disruptive behaviors in the classroom, as well as if it is successful in certain ages or all ages. Finally, future research should contemplate including a control group in the study. This study did not include a control group due to the sample size, but it would be beneficial to include a control group. A control group could convey other data findings and display more concrete proof of the study rejecting the null hypothesis or even identify different conclusions.

The duration of the study should be considered in any future research. This study included a pre-intervention week and six weeks of the intervention strategy. In future research, a

study of longer duration should be considered to see if the behaviors continue to decrease. Also, a future study should consider collecting several weeks of data regarding disruptive behavior. This could assist in identifying the effectiveness of this intervention. Furthermore, any future research should examine whom they choose as the researcher. This study utilized the classroom teacher as the researcher and data collector. It would be helpful if the researcher was just an observer for the study, as it would remove any kind of bias that could affect validity. Finally, the study could include different HIIT workouts for students. As there are many different ones a researcher could test to see the effect on disruptive behavior.

Conclusion

The intervention in this study required HIIT workout paths that lasted anywhere from 5 minutes to 7 minutes 3 times daily. The study's results demonstrated that HIIT workouts can significantly decrease different types of disruptive behavior. Not all of the disruptive behaviors decreased by the same amount or in the same week. Providing students with the opportunity to move, strengthen their bodies, and giving their brains a mental break can help them gain focus on the task and learning at hand. As many classroom teachers struggle with managing disruptive behaviors, this study provides another possible intervention to try in daily classroom life. The intervention can get students more active and provide them with a chance to release any frustration or pent up energy before disruptive behaviors escalate or even occur.

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Appendix A

Tracking Log

Week of: _____

Name	Hands on Others	Calling out	Talking to others/ self	Shutting down/refusal to do work	Hyperactivity (fidgeting, unable to focus)	Meltdown (crying, shutting down)	Yelling	Throwing Materials	Other