Physical Activity Intervention for ADHD and DBD

BY

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THESIS

Submitted as partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Kinesiology, Nutrition, and Rehabilitation
in the Graduate College of the
University of Illinois at Chicago**,** 2013

Chicago, Illinois

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I dedicate this work to all the kids out there who have ADHD, just like me. Being a kid with ADHD is tough, we get negative feedback in school and at home, are sometimes called "bad" or "dumb," and are told we can't. Too often we are labeled, medicated, and stigmatized, and it can be tough not to internalize that. But if we put our minds to it, if we harness our strengths and push our weaknesses, if we fight, there's nothing we can't do. *No te rindas.*

Here's a little quote my mom hung over my bed as a kid, enjoy:

Cuando las cosas vayan mal como a veces pasa.
Cuando el camino parezca cuesta arriba.
Cuando tus recursos mengüen y tus deudas suban,
Y al querer sonreir, tal vez suspiras.
Cuando tus preocupaciones te tengan agobiado,
Descansa si te urge, pero no te rindas.
La vida es rara con sus vueltas y tumbos
Como todos muchas veces comprobamos.
Y muchos fracasos suelen acontecer
Aún pudiendo vencer de haber perseverado.
Así es que no te rindas aunque el paso sea lento.
El triunfo puede estar a la vuelta de la esquina.
El triunfo es el fracaso al revés;
Es el matiz plateado de esa nube incierta
Que no te deja ver su cercanía...
Aún estando bien cerca.
Por eso, decídete a luchar sin duda,
Porque en verdad, cuando todo empeora,
el que es valiente, no se rinde, lucha!

ACKNOWLEDGEMENTS

This dissertation is the story of people that opened their arms to me when they didn't have to, who stuck with me when they didn't have to, who encouraged, critiqued, and invested in me, all when not doing so, likely would've saved them a lot of time and effort. Here I offer my sincerest thanks to each of you. My appreciation for your investments and sacrifice is profound. My cup runneth over.

First, my academic advisor and co-sponsor on this dissertation grant, Dr. David X. Marquez, who accepted me as a graduate student as an Assistant Professor in just his 3rd year out of graduate school, brought me with him to UIC, tolerated me and found me funding these 7-years, encouraged me to pursue a line of research that I was passionate about even though it was distinct from his own, and all in all, treated me like a son. Dr. Stacy L. Frazier who served as primary sponsor on the current grant, brought me into her research team, mentored me for 4-years, and connected me to her community partner despite the fact that I wasn't in her department, college, or even academic discipline. Better advisors don't exist.

Dr. Catherine L. Davis, dissertation committee member, who ate lunch with me twice in the first 2-days of my approaching her to express admiration for her work at a national conference. Besides introducing me to TED talks, Dr. Davis has been this study's bedrock for methodological rigor and internal validity over these past 3-years. Dr. Donald R. Hellison, dissertation committee member, who inspired me through his writings to pursue a line of research looking at physical activity and youth development and who brought me back time and again to viewing physical activity as a space, and not just a tool, for mental health promotion. Dr. Hellison has given generously of his time and feedback despite enjoying retirement after a long and illustrious career and therefore being under no obligation to participate in any academic activities whatsoever. Dr. Marc S. Atkins, dissertation committee member, who encouraged me to "come hang around" with his research team, and didn't protest when I didn't leave for 4-years. Dr. Louis Fogg, who put me through a full-on crash course in statistics all while

entertaining my endless questions and providing me supplementary reading materials. The fact that he is in extremely high demand at his institution and probably isn't supposed to be working with me at all makes me especially grateful for his help.

Special thanks to Dr. William Pelham, consultant, who generously helped to reformulate our diagnostic approach after it was dinged in our initial NIMH grant submission. Dr. Adele Diamond, consultant, who reviewed and provided feedback on our neurocognitive tasks. Dr. Daniel Corcos, who taught me how to write a grant and who when presented with my two ideas for a dissertation informed me that, "Well Eduardo, one sounds dreadfully boring and the other is utterly fascinating." Much of this project derived from that one sentence.

All of these individuals are highly accomplished and well-respected in their fields and when I approached each of them I fully expected to be turned away without a second thought. Don Hellison didn't have to care that I read his books. Daniel Corcos didn't have to go with me to get coffee. Katie Davis didn't have to take me to lunch because I told her I admired her work and certainly didn't have to invest so many hours into a pilot dissertation project. Stacy Frazier and Marc Atkins don't have to care that I was looking for interdisciplinary mentorship. And so on. I am humbled by their support and generosity and hope to pay it forward in the future in the case that I have a fraction of the success they have had.

Dr. Dana Rusch is a life saver. I asked her to train my 13 after-school intervention instructors, all of whom were UIC undergraduate and graduate students and none of whom had backgrounds in psychology, on how to run a program for 56 children from a broad age range, the vast majority of whom had diagnosable behavioral disorders, and all of whom faced difficult home, school, and neighborhood environments. Mind you, this request also needed to be done within 16-hours and without compensation. Of course, she said yes and then got it done. Her contributions didn't stop there though. When we were

struggling in the early weeks she was always my first call and always pushed us in the right direction. In this study, her achievements were remarkable.

I owe a special gratitude to my lead after-school instructors: Dana Kroop, Melissa Taylor, Melissa Heim, Tristessee Jones, and Adrienne Farrell. Each went above and beyond the call of duty to plan and lead the intervention activities, their passion and commitment shown through day after day, despite the fact that they were outnumbered, outgunned, and faced full graduate course loads, and in most cases, competing research programs and assistantships. The same goes for my undergraduate assistant instructors: Ike Ukeka, Rachel Volkl, Paul Pulpalaan, Paulius Smulkys, Michelle Miller, Jennifer Quijada, and Seena Mathew. Working with these undergraduate students was every bit as fun and meaningful as working with the kids themselves. This group is so talented and diverse and invested that they may have messed up my results.

They led book drives, took professional quality photos, developed arts and crafts activities, and bonded with the kids. In this intervention, each moment mattered, and each situation posed new challenges. Towards this end, my staff was diligent about thinking through each detail of each day, how are we going to get water to the kids without creating a huge mess? How can we smooth out the transition to the gym? What do they do with their bags and jackets when they arrive? How can we keep the volume low during homework time?

Most importantly, for all of my instructors, when we had a bad day, when we got run over, when we felt like we'd been punched in the stomach. They got themselves back up, dusted themselves off, and came right back the next day even stronger and more focused. Their patience with the kids, their ability to stay calm despite multiple stressors and challenges left an indelible mark on the kids, and I believe likely led to many of the benefits reported herein. Any errors, missteps, or failures in the current intervention are surely mine and mine alone.

I owe still more thanks to my data collectors: Nefertiti Oji-Njideka Hemphill, Elizabeth Adetoro, Carlos Martinez, Alexander Ayala, and Rosa Patino. Each did their best to move the study forward, put a ton of energy into recruitment, and worked long hours on data collection despite competing commitments and being stood up dozens of times. The task of being a good guest is difficult and each of these individuals excelled at that both at the school and in the lab. A special thank you to my lab mates Susie Aguiñaga and Sarah Janicek for tolerating all the commotion Project Play caused in the lab and lending a helping hand wherever possible.

This study would not have been possible without the unwavering support and commitment of the staff, teachers, and administrators at Robert Emmet Elementary school who stuck with us when we struggled and gave us every resource we needed to be successful. My most sincere gratitude to Emmet Elementary Principal Dr. Jacqueline A. Robinson and Assistant Principal Mr. Milo E. Love. Mr. Love stayed every day after school with us until 6:30pm so we could conduct the intervention even though he got in each morning by 5:30am and was under no obligation to stay at work for 13-hours each day. I owe a debt of gratitude to the Robert Emmet administrative staff as well, Ms. Thomas and Ms. Hardy, without whom nothing would have been accomplished, Ms. Reynolds who took the lead on recruitment through the multiple gating procedure, Mr. Reynolds and Mr. Smith who provided security when we needed it, and Mr. Brian who did 3 extra hours of cleaning each day for 3-months because of us and never once complained.

I owe more than can be quantified to my amazing "*gorgenius"* wife Mrs./Dr. Abigail S. Bustamante, and my sister-in-law/adoptive daughter Ms. Deja K. Richardson, who have tolerated my consistent absence over the past year, slept nights in my office, designed and created the beautiful materials used in our behavior management system, brought me dinner at absurd hours, and wrote me encouraging notes. A sentimental point here, while everyone else opened their arms to me figuratively,

Abigail and Deja opened their arms to me literally on nights that I would come home from Project Play after a rough day and say, "I need a hug."

Special thanks to my parents Ms. Hilda P. Bustamante and Dr. Eduardo M. Bustamante, both of whom are child professionals, my mom is a pediatric nurse practitioner and my father is an ADHD-positive clinical child psychologist and fitness fanatic, clearly, the apple doesn't fall far from the tree. I'm not sure what would've happened to me had I been raised by any other parents but with you as parents, I had no choice but to give it my all.

I have to express my thanks and admiration to the parents and teachers at Robert Emmet Elementary School. Your support was amazing and so are your children. I mentioned above a few times that we had rough days at Project Play but I would be remiss not to mention the vast majority of days in which the children inspired us with their progress. The absurdly funny stories and memories I will never forget and the many times I went home smiling until my cheeks hurt, feeling plain elated and on top of the world. If I could, I would start the program back up again tomorrow just to spend time with those kids, and I would bet my doctorate there isn't an instructor on my staff that feels any differently.

Finally, this study would not have been possible without funding from a National Institute of Mental Health (NIMH) R36 Dissertation Grant to Increase Diversity (R36 MH093152-01A1, PI: Bustamante, Eduardo), a sincere thank you to NIMH for providing me this opportunity.

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LIST OF ABBREVIATIONS

DBD	Disruptive Behavior Disorders
ADHD	Attention Deficit Hyperactivity Disorder
ODD	Oppositional Defiant Disorder
CD	Conduct Disorder
EF	Executive Function
RCT	Randomized Controlled Trial
GBG	Good Behavior Game
GNN	Good News Note
AWMA	Automated Working Memory Assessment System
BRIEF	Behavioral Rating Inventory of Executive Function
GEC	Global Executive Composite Score
MI	Metacognition Index
SSiS	Social Skills Improvement Sytem
BOSS	Behavioral Observation of Students in Schools
PACER	Progressive Aerobic Cardiovascular Endurance Run
DISC-IV-P	Diagnostic Interview Schedule for Children, Version IV, Parent Version
IRS	Impairment Rating Scale
CBM	Curriculum-Based Measure
HR	Heart Rate
HRM	Heart Rate Monitor
MHR	Maximum Heart Rate
%MHR	Percent Maximum Heart Rate
PI	Principal Investigator

LIST OF ABBREVIATIONS (CONTINUED)

CPS	Chicago Public Schools
CPD	Chicago Park District
GPA	Grade Point Average
ISAT	Illinois Standardized Achievement Test
CPS RRB	Chicago Public Schools Research Review Board
UIC	University of Illinois at Chicago
UIC IRB	University of Illinois at Chicago Institution Review Board
UIC GC	University of Illinois at Chicago Graduate College
CITI	Collaborative Institutional Training Initiative
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders, Version IV
fMRI	Functional Magnetic Resonance Imaging
CTU	Chicago Teacher's Union
PMCTRS	Pittsburgh Modified Conner's Teacher Rating Scale
ADHD-RS-IV	Attention Deficit Hyperactivity Disorder Rating Scale IV
CPC	Children's Problems Checklist

SUMMARY

The current study used a randomized controlled design to test the feasibility and impact of an aerobic physical activity after-school program for children with Attention Deficit Hyperactivity Disorder (ADHD) and Disruptive Behavior Disorders (DBD) living in an urban poor community. Epidemiological studies estimate the community prevalence of ADHD to be between 8 and 23%, and DBD to be between 5% and 9%. The disorders are highly comorbid and rates are reported to be nearly three times higher among African American and urban poor communities where the resources available to meet the need are severely limited. If untreated, children with ADHD and DBD are likely to suffer long-term impairments across multiple domains.

Evidence-based interventions for ADHD and DBD are psychopharmacological and psychosocial. Though both are effective, some children are unresponsive to or experience unwanted side effects from medications, and psychosocial treatments require considerable time and resources. Schools provide 70-80% of psychosocial services and the unfortunate reality in low-income schools is that limited resources, deteriorating conditions, high staff stress, and pressure to improve standardized test scores make the time and resource investments associated with mental health consultation and program implementation especially challenging. Consequently, rates of service utilization are extremely low in urban poor communities.

This study builds on a sizeable literature demonstrating that ADHD is characterized by, and DBD has been associated with, impairments in the development of EF; and that aerobic activity disproportionately influences EF processes and the brain areas that support them. While direct investigation of this effect in children with ADHD and DBD are sparse, preliminary findings are promising. This evidence, coupled with the great need for development of evidence-based interventions for childhood ADHD and DBD that improve daily functioning, are low cost, and have potential for

broad dissemination suggests that aerobic activity warrants investigation as a potential tool in the broad treatment and management of ADHD and DBD in urban poor communities.

The current study randomized children with ADHD and/or DBD to either a treatment condition, an evidence-based 10-week after-school aerobic activity intervention demonstrated to improve EF in overweight non-disruptive children, or an attention control condition, which was logistically similar but sedentary. It aimed to (1) test the feasibility of the treatment condition for children with ADHD and DBD living in a high poverty community via attendance records, retention rates, heart rate monitors, and parent and student focus groups; (2) examine whether the EF benefits of aerobic activity apply to children with ADHD and DBD via the Behavioral Rating Inventory of Executive Function and neuropsychological tasks; and (3) determine the extent to which the intervention influenced children's behavior and academic performance via teacher-report, parent-report, direct observation, and curriculum-based measures.

56 participants from 35 families (43 children with ADHD or DBD and 13 non-disruptive siblings) enrolled in the current study. Feasibility was evidenced by a 63% attendance rate and an 89% retention rate. Heart rate monitor records averaged a daily duration of M = 28.83, SD = 13.16 minutes and an average daily heart rate of M = 141.32, SD = 14.79 beats per minute (bpm), which corresponded with an individualized percentage of Maximum Heart Rate of 74%, which is in the moderate-vigorous range. Finally, preliminary analyses of participant focus groups revealed widespread program satisfaction among parents and children, perceptions of social and emotional benefits for participants in both groups, and concerns and suggestions related to the exposure of non-disruptive siblings to disruptive peers, separation of siblings across groups, and the duration of the program.

In order to test a *priori* hypotheses of impact between groups over time, a linear mixed effects model was tested for group x time interaction. This analysis was followed by paired sample *t*-tests for

within group time effects, and Cohen's *d* for change over time within and between groups. Analyses, were initially run utilizing an intent-to-treat (ITT) approach, and then the approach was duplicated in a per protocol analysis in which only students that attended ≥ 3-days per week were included. The primary outcome measure, the Global Executive Composite (GEC) score of the Behavioral Rating Inventory of Executive Function (BRIEF), did not reach or trend towards significance in the linear mixed effects model in either the intent-to-treat (ITT) (*t*-score $p \geq .10$, $d = 0.22$, percentile $p \geq .10$, $d = 0.22$) or per protocol analysis ($p \geq .05$, $d = 0.29$; percentile rank $p \geq .05$, $d = 0.47$).

Among exploratory outcomes, a group x time interaction favoring treatment was observed in the ITT mixed effects model for the Internalizing Subscale of the Social Skills Improvement System (SSiS) only ($p \leq .05$, $d = 1.27$). No other group x time interactions reached or trended towards significance in the ITT linear mixed effects model (ps $\geq .10$, $d = -0.92$ to 0.90). In the per protocol analysis of exploratory outcomes, group x time trends emerged in favor of the treatment group for Automated Working Memory Assessment System (AWMA) Verbal Short-Term Memory (standard score $p \leq .10$, $d = 0.46$; percentile $p \leq .10$, $d = 0.38$), the Internalizing Subscale of the SSiS ($p \leq .10$, $d = 1.27$), and Music GPA ($p \leq .10$, $d = 0.79$), all of which fell below $p \leq .10$ after controlling for baseline differences between groups on participant characteristics and participation indicators. In contrast the Autism Spectrum Subcale of the SSiS ($p \leq .10$, $d = -1.38$) trended in favor of the control condition and the trend remained even after controlling for baseline characteristics and participation indicators. No group x time interactions reached significance in the per protocol mixed effects model.

The current study demonstrated the feasibility of the Project Play intervention in a sample of predominantly African-American low-income primary school children with ADHD and/or DBD. The primary outcome in the current study did not reach significance and across all 10 measures only one subscale of one measure reached significance. These null findings are in contrast to the 3 previous published controlled trials of regular physical activity interventions in children with ADHD and/or

DBD. However, the current study utilized greater methodological rigor (i.e., randomization, diagnostic interview, rotation of staff between groups, adherence measures, widely-used outcome measures, collection of potential confounders, blinding of data collectors to condition, objective and subjective outcomes, and presentation of ITT analyses) and a more stringent test of the executive control hypothesis than previous trials in this population through utilization of a sedentary attention control condition. The latter is a novel addition to the literature and controls for benefits likely to derive from participation in any structured out-of-school program conducted by prosocial adults with opportunities for play and social interaction (independent of whether activities are sedentary or physically active).

Within-group effect sizes in the treatment group were comparable to or greater than previous studies in this population, however, similar growth was also evident in attention controls, suggesting the possibility that much of the benefit derived from PA interventions in this population is due to features of the intervention besides the PA itself. Nevertheless, small-moderate effect sizes favoring the treatment group were evident across the vast majority of cognitive measures and daily average % maximum heart rate (%MHR) was associated with adaptive change scores in cognitive and behavioral outcomes in the treatment group. Limitations, such as, short duration, missing data, small sample size, and potentially insufficient PA intensity, temper the conclusions that can be drawn from this pilot feasibility trial.

I. INTRODUCTION

A. Attention Deficit Hyperactivity Disorder and Disruptive Behavior Disorders Associated with Long-Term Impairments and Costs for Youth

Attention Deficit Hyperactivity Disorder (ADHD) is characterized by developmentally excessive inattention, hyperactivity, and/or impulsivity that disrupts functioning in multiple settings (*Diagnostic and Statistical Manual of Mental Disorders (4th ed.)* 1994). Oppositional Defiant Disorder (ODD) and Conduct Disorder (CD), herein referred to as Disruptive Behavior Disorders (DBD), have been conceptualized as sharing a developmental trajectory characterized by elevating hostile and defiant behaviors that violate age-appropriate norms and rules (Loeber and Keenan 1994; *Diagnostic and Statistical Manual of Mental Disorders (4th ed.)* 1994). Community prevalence of ADHD is estimated between 8% and 23% (Nolan, Gadow, and Sprafkin 2001; AAP 2000; CDC 2001; Allen 1980), and DBD between 5% and 9% (Nolan, Gadow, and Sprafkin 2001). The disorders are highly comorbid, between 40% and 65% (Atkins and McKay 1996; Barkley 1998).

Unfortunately, rates are nearly three times higher in African American (Nolan, Gadow, and Sprafkin 2001) and urban poor communities (Guerra et al. 1995; Tolan and Henry 1996; Green et al. 2005; Strohschein 2005). If untreated, children with ADHD are likely to suffer impairments in socialization and academic performance that persist into adulthood and impact educational, employment, driving, sexual, reproductive, and relationship outcomes (Barkley 2002). Children with ADHD and DBD are highly susceptible to delinquent life trajectories (Barkley 1998; Farrington and Loeber 1999), as evidenced by their overrepresentation in incarceration facilities (Gordon and Moore 2005; Rutherford et al. 2002). Financially, these disorders represent one of the greatest youth-related costs to society in expensive treatments and services (Eddy 2006; Farrington and Loeber 1999; Guevara et al. 2003). The high prevalence of ADHD and DBD and their associated long-term impairments in urban poor communities are especially disconcerting given the limited resources available to meet the

needs (Kataoka, Zhang, and Wells 2002). Recent evidence serves only to elevate concerns, suggesting that the combination of high ADHD and DBD prevalence and low treatment rates are a driving force in the widening academic achievement gap between urban minority youth and majority middle-income communities (Basch 2011b, 2011a) .

B. Current Interventions Insufficient to Meet Needs in Urban Poor Communities

Evidence-based interventions for ADHD are psychopharmacological and psychosocial. Medication is moderately effective for many children with ADHD (Ipser and Stein 2007; Thurber and Walker 1983). Unfortunately, 20% of medicated children experience side effects: insomnia, social stigma, mood disturbance, appetite suppression, or high blood pressure (Barkley 1998). Psychosocial interventions are highly effective for both ADHD and DBD (Fabiano et al. 2009) but require extensive time and effort by caregivers via training and behavior management programs. Schools provide 70-80% of psychosocial services delivered (Rones and Hoagwood 2000), however, in low-income schools, limited resources, deteriorating conditions, high staff stress, and pressure to improve standardized test scores make the time and resource investments associated with intervention implementation especially challenging (Atkins et al. 2003; Boyd and Shouse 1997). Consequently, an analysis of three national surveys indicated that nearly 80% of low-income youth, and 90% of uninsured youth, in need of mental health services had not received any within the preceding 12 months (Kataoka, Zhang, and Wells 2002). For those who do receive services, attrition rates exceed 50%, especially for low-income, African-American children (Kazdin 1996; McKay et al. 2003; Pottick, Lerman, and Micchelli 1992). The unfortunate reality for children in urban poor communities is that mental health treatment is largely unaffordable and inaccessible, leading to disparities in utilization rates by race/ethnicity, income, and insurance status (Pastor and Reuben 2005).

C. Executive Function Deficits in Attention Deficit Hyperactivity Disorder and Disruptive Behavior Disorders

EF is a broad construct encompassing the higher order cognitive functions necessary for reasoning, problem solving, planning, organization, and behavioral execution (Suchy 2009). Diamond (2013) recently provided a parsimonious definition of EF, breaking it down into 3 major components: inhibition, working memory, and cognitive flexibility.

Inhibition is defined by Diamond as, "controlling one's attention, behavior, thoughts, and/or emotions to override a strong internal predisposition or external lure" (Diamond 2013). An example of inhibition would be stopping oneself from blurting out something emotional or impulsive, in favor of momentarily biting one's tongue and thinking of something more thoughtful to say. Self-control (e.g., avoiding excessive consumption of unhealthy foods) and self-discipline (e.g., persisting at a task even though you'd rather stop), inhibiting thoughts and memories, and paying attention while ignoring distractions also fall under the umbrella of inhibition.

Working Memory refers to "holding information in mind and mentally working with it" (Diamond 2013). One's ability to remember a point one wishes to make in conversation while continually listening and waiting for one's turn to speak is a manifestation of working memory. Everyone has said, "I forgot what I was going to say" in conversation and in that moment we have experienced a failure of working memory. Anyone who has tried to play dominoes knows that the capacity to count the pieces that have been played while simultaneously calculating the odds that another player has a given piece is finite, its limit is the limit of one's working memory. Working memory is distinct from short-term memory in that short-term memory only requires one to hold in mind information (e.g., remember a telephone number - 4132533737), while working memory requires one to hold the numbers in mind while simultaneously manipulating them (e.g., listening to a telephone number

and re-organizing the numbers in descending order - 7754333321). Working memory is theorized to break down into 3 underlying cognitive processes: domain-specific verbal storage, domain-specific visuo-spatial storage, and a shared component for processing information (Alloway, Gathercole, and Pickering 2006).

Finally, cognitive flexibility is the most advanced of the core EFs and refers to "changing perspectives or approaches to a problem, flexibly adjusting to new demands, rules, or priorities" (Diamond 2013). Examples include, putting asides one's personal views on an issue to considering another's perspective or changing strategies in a game of chess.

Together these three major EFs generate higher-level executive functions, including, reasoning, problem solving, planning, and fluid intelligence (Muraven and Baumeister 2000). All three EFs are highly related and co-dependent but also distinct. Working memory cannot function without inhibiting unwanted thoughts to clear space for the desired content; you will never calculate the odds of a player having a given domino if you can't stop thinking about the movie you watched last night. Similarly, cognitive flexibility cannot be effective without working memory; one cannot switch between approaches to a problem without holding in mind the various options and weighing their pros and cons. Like all processes utilizing effortful mental exertion, EFs are fatigable and trainable (Muraven and Baumeister 2000; Muraven, Baumeister, and Tice 1999), and while they are difficult for all of us they are especially difficult for children with ADHD and DBD.

Barkley (1997, 2001) first argued that ADHD is the behavioral manifestation of impairments in the development of executive function (EF) (Barkley 1997; Barkley 2001). Substantial evidence supports Barkley's hypothesis. Specifically, among children with ADHD, impairments have been found in the EF domains of attentional vigilance (Tantillo et al. 2002), cognitive flexibility (Romine et al. 2004), inhibition of conflicting and pre-potent response (Iaboni, Douglas, and Baker 1995; Shue and

Douglas 1992; Trommer et al. 1988), spatial & verbal working memory (Barkley, Murphy, and Bush 2001), planning (Wodka et al. 2008), organization (Shin et al. 2003), and emotional regulation (Rydell, Berlin, and Bohlin 2003).

A fast growing body of research investigates the neurophysiological dysfunctions underlying ADHD, but they are still not fully understood. Briefly, evidence suggests that functional and structural abnormalities (e.g., catecholamine dysregulation (Casey et al. 1997; Filipek, SemrudClikeman, et al. 1997; Heilman, Voeller, and Nadeau 1991; Hynd et al. 1993a; Hynd et al. 1990; Prince 2008; Sagvolden et al. 2005) and blood flow/volume asymmetries (Castellanos et al. 1996; Filipek, Semrud-Clikeman, et al. 1997; Hynd et al. 1993b) in the frontal lobes) form the fundamental pathophysiological foundation of the disorder. To date, research examining EF deficits in children with DBD is equivocal (Hummer et al.; Qian et al. 2010; Sergeant, Geurts, and Oosterlaan 2002; Fairchild et al. 2009; Broidy et al. 2003). Variations and limitations in diagnostic procedures, control for comorbid ADHD, and EF measures have contributed to the discord in findings (Hummer et al.; Qian et al. 2010; Sergeant, Geurts, and Oosterlaan 2002; Broidy et al. 2003; Fairchild et al. 2009). Parent- and teacher-report measures, such as the BRIEF, appear to be more sensitive to EF deficits than neuropsychological tasks in children with DBD (Hummer et al. 2010; Qian et al. 2010; Rones and Hoagwood 2000; Prince 2008). Evidence suggests that deficits in EF are a core feature of ADHD and that behavior concurrent with EF deficits manifest in children with DBD in the environments that parents and teachers observe them on a daily basis (Qian et al. 2010).

D. Aerobic Activity Improves Executive Function

In 1999, Kramer et al. put forth the "executive function hypothesis," which states that EF processes and the brain areas that support them are disproportionately influenced by aerobic physical activity (Churchill et al. 2002; Colcombe and Kramer 2003; Hall, Smith, and Keele 2001; Kramer et al.

1999). Growing empirical evidence has since emerged demonstrating EF benefits of aerobic activity across the lifespan, including childhood (Tomporowski et al. 2008; Davis and Pollock 2012), with benefits across tasks of attentional vigilance (Masley, Roetzheim, and Gualtieri 2009; Tantillo et al. 2002; Hillman et al. 2009), cognitive flexibility (Masley, Roetzheim, and Gualtieri 2009; Pesce, Cereatti, et al. 2007; Pesce, Tessitore, et al. 2007), inhibition (Audiffren, Tomporowski, and Zagrodnik 2009; Joyce et al. 2009; Hillman et al. 2009; McMorris et al. 2009; Hillman et al. 2006; Hogervorst et al. 1996; Hillman, Snook, and Jerome 2003; Lichtman and Poser 1983; Sibley, Etnier, and Le Masurier 2006; Davranche, Hall, and McMorris 2009; Davranche and McMorris 2009; Tomporowski 2003; Chaddock-Heyman et al. 2013), working memory (Hancock and McNaughton 1986; Faber Taylor and Kuo 2008; Audiffren, Tomporowski, and Zagrodnik 2009; Pontifex et al. 2009; Kamijo et al. 2011), planning (Davis et al. 2007; Davis et al. 2011) and creativity (Tuckman and Hinkle 1986; Gondola 1987; Hinkle, Tuckman, and Sampson 1993; Wigal et al. 2003). Empirical evidence suggests that regular aerobic activity impacts EF by altering neurophysiological function (Colcombe, Kramer, Erickson, et al. 2004; Kramer et al. 1999; Weuve et al. 2004). Aerobic activity increases growth factors such as brain derived neurotrophic factor and vascular endothelial growth factor (Dishman 2006), leading to increased capillary blood supply to the cortex (Ogoh and Ainslie 2009) and growth of new neurons and synapses (Colcombe, Kramer, McAuley, et al. 2004), resulting in better learning and performance (Dishman 2006). Additionally, acute bouts of aerobic activity improve catecholamine regulation (the target of psychopharmacological interventions) in the frontal lobes (Freed and Yamamoto 1985; Hattori, Naoi, and Nishino 1994; Heyes, Garnett, and Coates 1988; Yadid, Overstreet, and Zangen 2001; Tantillo et al. 2002; Wigal et al. 2003; McMorris et al. 2009).

While much of the strongest evidence for EF benefits from PA is derived from animal studies, acute bout studies (studies investigating the impact of a single bout of physical activity [i.e., some

number of minutes undertaken only a single time]), observational studies, and RCTs in older adults, a few recent RCTs in children provide preliminary support for a causal relationship between physical activity and EF improvements (Davis and Pollock 2012). In 2007, a randomized controlled trial by Dr. Catherine L. Davis (Consultant) demonstrated a significant dose-response effect in intent-to-treat analyses for EF (operationalized as planning) and alterations in prefrontal cortex activity as measured by fMRI (functional magnetic resonance imaging) between overweight children randomized to either a high dose (40-minutes of PA/day) or low dose (20-minute of PA/day) after-school program, or a no-intervention group for 12-weeks (Davis et al. 2007; Davis et al. 2011).

A second RCT by Kamijo et al. (2011) randomized 43 children to a physically active after-school program or wait-list control and demonstrated significant differences in changes on a working memory task and larger contingent negative variation (CNV) at the frontal electrical site between groups from baseline to posttest (Kamijo et al. 2011). A third RCT, conducted by Chaddock-Hayman et al. (2013) randomized 32 children to a 9-month after-school program or wait-list control. No significant differences were found between groups over time on an inhibition task in per protocol analyses. However, paired sample *t*-tests revealed significant within-group improvements on the inhibition task in the exercise group but not the control group (Chaddock-Heyman et al. 2013). A significant group x time interaction was observed in this study on fMRI results for activation in the right anterior prefrontal cortex, however, and this effect brought the treatment group closer to the functioning of healthy young adults than controls (Chaddock-Heyman et al. 2013).

Finally, Krafft et al. (in press) randomized 43 overweight children to either an aerobic exercise after-school program or a sedentary attention control after-school program every day for 8-months (Krafft et al. In Press). Similar to Chaddock-Hayman et al. (2013), intent-to-treat analyses revealed group x time interactions for fMRI outcomes but not inhibition task performance. However, in this case,

both the control and treatment conditions significantly increased their performance on the inhibition tasks and group differences were not evident over time. Taken together, these results suggest that the EF benefits of aerobic activity make it a promising tool in the treatment of ADHD and DBD (see Figure I).

Figure 1: Conceptual Model

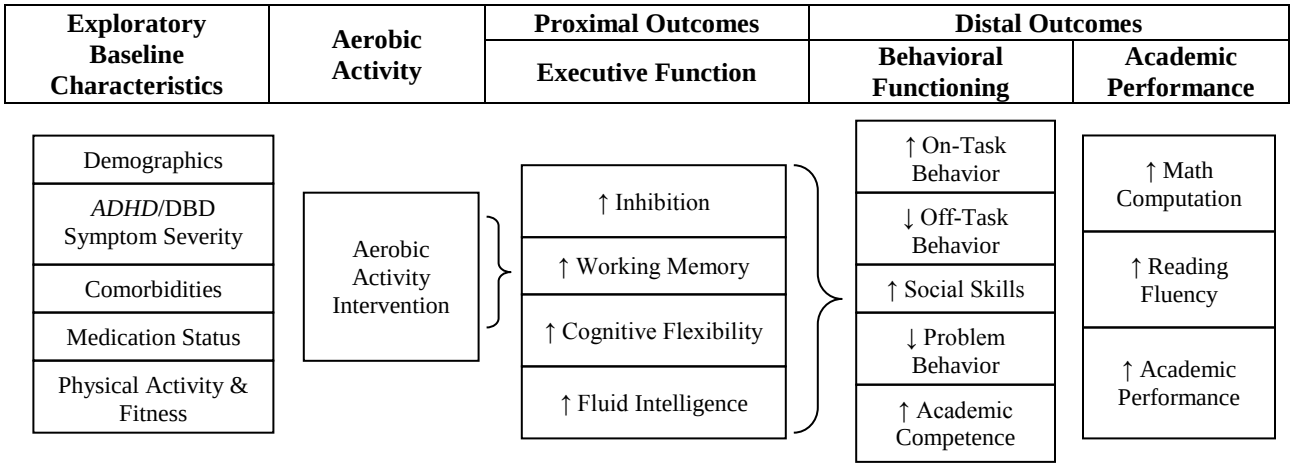


Figure I illustrates that EF is the mechanism by which the aerobic activity intervention was hypothesized to influence behavior and academic performance. Individual baseline characteristics were explored as *potential* moderators of intervention impact.

E. Implications for Future Research and Practice

There is great need for evidence-based interventions for ADHD and DBD that improve children's daily functioning, are low cost, and have potential for broad dissemination (Baker, McFall, and Shoham 2008; Shumway and Sentell 2004; Weisz, Doss, and Hawley 2005). The current study adapted an evidence-based after-school aerobic activity intervention that has been demonstrated to improve EF in non-disruptive children (Davis et al. 2007) and tested its feasibility and impact for children with ADHD and DBD living in an urban poor community. Regular aerobic activity may permit

reduction of the medication dose, provide reprieve to children unresponsive to medication, those that do not have access to medication, those for whom medication does not provide sufficient symptom relief, and those for whom the side effects disrupt their daily functioning via sleep, mood, and appetite changes. Implications extend to the management of children with ADHD and DBD by clinicians, parents, teachers, and schools, such that physical activity may be considered as part of a broader treatment plan. The current study yielded critical information for the further development, refinement, and examination of the aerobic activity intervention through future research grant applications.

F. Innovation

Few studies have directly investigated the influence of physical activity on children with ADHD or DBD. Some of the most promising findings derive from studies examining the influence of acute bouts of physical activity on the cognitive performance of children with ADHD (Tantillo et al. 2002; Pontifex et al. 2013; Medina et al. 2010). These studies suggest that acute effects of physical activity may prove extremely helpful for managing ADHD and DBD, and corroborate findings from interventions implemented into the school day that have demonstrated improvements in behavior after physical activity bouts and on days in which physical activity was offered relative to days in which it was not (Allen 1980; Barros, Silver, and R.E.K. 2009; Bass 1985; Cannella-Malone, Tullis, and Kazee 2011; Mahar et al. 2006). In this sense, PA acts similar to methylphenidate, improving functioning for some time after it's consumption but the effect wears off within a few hours.

A related line of research examines the potential for regular physical activity to alter the developmental trajectory of ADHD through preventive PA programs at early ages (Halperin and Healey 2011). Here the focus is on the potential of the accumulation of many acute bouts of physical activity over time to provide a benefit towards the normalization of neurocognitive development in children with

ADHD above and beyond the time-limited effects evident for the hours after PA has been completed (Halperin and Healey 2011).

To this end, we are aware of seven published studies that have tested the effect of regular physical activity on children with ADHD and/or DBD (Kang et al. 2011; Verret et al. 2012; Smith et al. 2013; Halperin et al. 2012; Gapin and Etnier 2010, 2012; McKune, Pautz, and Lombard 2003). In addition to these published studies we are aware of two unpublished doctoral theses (Wendt 2000; Morand 2004) investigating the impact of chronic aerobic activity interventions on cognition and behavior for children with ADHD and/or DBD. These unpublished studies demonstrated positive results but suffered from methodological limitations and did not undergo peer review and therefore, results must be considered tentatively.

Among the published studies, Gapin and Etnier (2010) distributed accelerometers and conducted four neurocognitive tasks with 18 children with ADHD. Results demonstrated large correlations between daily minutes of MVPA and Tower of London Total Move Score (r = .57, $p \leq .05$) and Total Execution Time (r =.53, $p \leq .05$), but not measures of inhibition, working memory, or processing speed. Gapin and Etnier (2013) also investigated parental perceptions of the impact of physical activity on children with ADHD. Parents (n = 68) reported that they believed regular physical activity positively impacted symptoms (Gapin and Etnier 2012).

The remaining 5 published studies conducted physical activity interventions in children with ADHD. Smith et al. (2013) conducted a single group 8-week before-school physical activity intervention for 17 children in grades K-3 (Smith et al. 2013). Among 8 neuropsychological measures, one inhibition task (Shape School, Condition B) achieved statistical significance from baseline to posttest in a paired t-test among program completers only. The only working memory task, digit span backwards, demonstrated a small effect size in the adaptive direction (d = .43). Results were more

promising for parent and teacher reports of hyperactive, inattentive, oppositional, and impulsive behavior, where all changed significantly from baseline to posttest with small to moderate effect sizes (*d* = .40 to .70).

Halperin et al. (2013) conducted a single group pilot of a parent-management training program for 29 4-and 5-year-olds evidencing high levels of ADHD symptoms, half of whom also met criteria for ODD based on parent and teacher ratings (Halperin et al. 2012). This study was unique in that it consisted of weekly small-group meetings, in which parents were trained on how to play a variety of physically active games chosen to exercise aspects of EF, such as inhibition (simon says and freeze dance), working memory (treasure hunts), and planning (e.g., packing for a picnic), in addition to vigorous aerobic exercises such as jumping jacks and burpees. Improvements in parent-reported ADHD and DBD symptoms and impairment remained significant up to 3-months after the intervention (Halperin et al. 2012).

The 3 remaining publications all utilized control conditions (Kang et al. 2011; Verret et al. 2012; McKune, Pautz, and Lombard 2003). McKune et al. (2003) non-randomly assigned 13 ADHD children to a 5-week exercise program and six ADHD children to a no-intervention control condition. The main outcome was parent-reported behavior on the Conner's Parent Rating Scale (total behavior, attentive behavior, task orientation, emotional behavior, motor skills, and oppositional behavior). There were no significant differences between groups over time as both groups improved on a variety of outcomes: total behavior ($p \leq .01$), attention ($p \leq .01$), emotional ($p \leq .01$), and motor skills ($p \leq .01$).

Verret et al. (2012) non-randomly assigned 21 7- to 12-year-olds to either a three time/week 10-week physically active program during lunch time or a no-intervention control. Findings were null for an inhibition task (walk/don't walk), but a significant group x time effect for tasks reported to measure sustained attention and information processing (Sky Search). Again, stronger findings were evident for

parent and teacher reports where a total problems scale, and social, thought, and attention Subscales all reached significance, and a trend was observed for withdrawn-depression score (Verret et al. 2012).

Finally, Kang et al. (2011) provided the most rigorous test of the influence of PA on cognition and behavior of children with ADHD in the literature to date (Kang et al. 2011), randomizing 32 children with ADHD to a biweekly 6-week sports therapy group or an education control group. All children received methylphenidate during the first week of participation. The sports therapy group was led by one psychiatrist, one sport psychologist, and two teaching assistants majoring in sports psychology and lasted for 90-minute, and consisted of vigorous aerobic exercises, staggered with brief rest periods. Activities were both goal-directed and non-goal-directed, and time for discussion was included before and after. The education control condition also met 12-times and consisted of discussions regarding approaches to ADHD management. Significant group x time interactions emerged for working memory (digit symbol score) and cognitive flexibility (trail-making test-B) in per protocol analyses on 28 children that adhered to the program. Parent behavior report on the Social Skills Rating Scale (SSRS) revealed significant differences between groups on the Cooperativeness Subscale raw score but not on the Self-Control or Assertiveness Subscale raw scores.

These studies provide important insights into the palatability and promise of PA interventions for ADHD but methodological shortcomings limit inferences that can be derived regarding the effect of PA on cognition and behavior in children with ADHD or DBD (Gapin, Labban, and Etnier 2011). Across the seven intervention studies, including the two unpublished doctoral dissertations, two were uncontrolled trials (Halperin et al. 2012; Smith et al. 2013), which severely limit inference because it is impossible to know whether improvements from baseline to posttest are due to the intervention or secular trends. The five remaining studies utilized control groups but four did not randomize participants

to groups and utilized no-intervention control conditions as the comparison group (Morand 2004; Verret et al. 2012; Wendt 2000; McKune, Pautz, and Lombard 2003).

The issue of no-intervention controls is pertinent to interpreting both the smaller PA and ADHD literature and also the broader physical activity and cognition literature because without a comparable but sedentary attention control group it is difficult to tease out whether the benefits derived are due to the physical activity or other aspects of structured programs such as rules, rewards and punishments for behavior, social interaction with prosocial peers and adults, even the stability of routines or simple decreases in screen time and exposure to antisocial peers and adults (Kamijo et al. 2011; Frazier, Mehta, et al. 2012).

Finally, Kang et al. (2011), addressed many of the shortcomings of previous interventions, including randomizing participants to condition and utilizing an active control condition. Nevertheless, it is unclear how well-matched the education control group, which involved seated discussion for an unspecified duration with unspecified staff, was to the treatment group's sports therapy intervention which was co-facilitated by 2 doctoral level clinicians, involved active structured play, and provided rewards for good behavior. Therefore, including an education control condition was a strength of the study, but the design nevertheless appears insufficient to isolate the impact of PA on outcomes among ADHD children (Kang et al. 2011).

Studies also were limited by presenting per protocol analyses only (Morand 2004; Smith et al. 2013; Wendt 2000), which may bias results if participant attrition is non-random (Montori and Guyatt 2011). None of the studies described a blind for parent and teacher-reporters or testers for neurocognitive tasks, which can cause expectancy effects among reporters, especially without any placebo control, and bias in test implementation for neurocognitive tasks (Halperin et al. 2012; Kang et al. 2011; Morand 2004; Smith et al. 2013; Verret et al. 2012; Wendt 2000; McKune, Pautz, and

Lombard 2003). Similarly, none of the studies listed siblings as exclusion criteria or mentioned whether siblings were included in the sample. Because siblings share genetics and environments their outcomes are not independent and therefore, their unadjusted inclusion in analyses induces bias (Hanley et al. 2002).

Finally, insufficient attention has been given to the behavior management strategies utilized in both intervention and control conditions across studies, and how potential disparities between groups on this factor may be impacting observed findings. In all, one study claimed that they intentionally did not use a behavior management plan (Smith et al. 2013), a second only mentioned that one was implemented to maintain an acceptable level of behavior but did not describe it (Halperin et al. 2012), and a third briefly mentioned providing candies and small prizes to children for good behavior in the treatment group only but provided no further details (Kang et al. 2011). The remaining three studies made no mention of how behavior was managed, how engagement was achieved, or how misbehavior was addressed, despite the fact that samples in these studies were composed entirely of children with behavioral disorders, and therefore, misbehavior undoubtedly occurred (Morand 2004; Verret et al. 2012; Wendt 2000; McKune, Pautz, and Lombard 2003).

The current study builds upon these studies and the broader literature by investigating the feasibility and impact of a 10-week after-school physical activity intervention for children with ADHD and DBD living in an urban poor community. The current study is characterized by adequate power, fidelity measures, valid and widely-used objective and subjective outcome measures across conceptually related domains, randomization of participants, blinding of data collectors, and collection of multiple potential confounders.

Perhaps most importantly, the current study used an attention control condition tailored to be as similar as possible to the treatment condition, including its staff and behavior management program,

with the exception of its designed sedentariness. This adaptation controls for the impact of social interaction and impacts of behavior management strategies by holding them constant among groups, effectively isolating the PA as the sole difference in the activities between groups (Krafft et al. In Press). An additional advantage is that the attention control condition was presented to staff, raters, and participants as an active intervention expected to lead to benefits, which may slightly address expectancy bias stemming from the inability of researchers to blind parents to group randomization in PA trials utilizing no-intervention controls. Including a sedentary attention-control condition extends prior literature and allows closer examination of the impact of physical activity on EF and child functioning above and beyond the impacts expected from any structured program providing exposure to prosocial adults (Krafft et al. In Press).

II. SPECIFIC AIMS

The current study used a randomized controlled design to test the feasibility and impact of aerobic activity for children with Attention Deficit Hyperactivity Disorder (ADHD) and Disruptive Behavior Disorders (DBD) living in an urban poor community. Epidemiological studies estimate the community prevalence of ADHD to be between 8 and 23% (Nolan, Gadow, and Sprafkin 2001), and DBD to be between 5% and 9%. Rates are reported as high as three times national estimates among African American (Nolan, Gadow, and Sprafkin 2001) and urban poor communities (Guerra et al. 1995; Tolan and Henry 1996; Green et al. 2005; Strohschein 2005) where the resources available to meet the need are severely limited (Kataoka, Zhang, and Wells 2002). Evidence-based treatments for ADHD and DBD include psychopharmacological and psychosocial interventions. For families in poverty, medications are too often inaccessible, costly, and accompanied by unwanted side effects (Barkley 1998); and clinic- and school-based psychosocial interventions although highly effective (Fabiano et al. 2009) require extensive time, effort, and resources by parents and teachers, and thus are vastly underutilized (Kataoka, Zhang, and Wells 2002; Atkins et al. 2003; Boyd and Shouse 1997; McKay 2000).

This study responds to the ongoing need for evidence-based interventions that improve daily functioning in children with ADHD and DBD, are low cost, and have potential for broad dissemination and utilization in urban high poverty communities (Baker, McFall, and Shoham 2008; Shumway and Sentell 2004; Weisz, Doss, and Hawley 2005). Deficits in executive function (EF) (responsible for reasoning, planning, organization, problem solving, and behavioral execution) have been shown to underlie childhood ADHD (Barkley 1997; Barkley 2001; Brown 2000, 2005), and have been associated with DBD (Qian et al. 2010; Sergeant, Geurts, and Oosterlaan 2002), and a sizable literature suggests that regular aerobic activity improves EF across the lifespan (Colcombe and Kramer 2003; Hillman, Erickson, and Kramer 2008; Davis et al. 2007; Hillman, Castelli, and Buck 2005; Davis et al. 2011;

Kamijo et al. 2011). Therefore, to the extent that improvements in EF impact behavioral and academic functioning, children with ADHD and DBD experiencing impairments in these domains stand to benefit from an aerobic activity intervention (St Clair-Thompson and Gathercole 2006).

Children with ADHD and/or DBD were randomized to an evidence-based 10-week after-school aerobic activity intervention demonstrated in prior research to improve EF in a community sample of overweight non-disruptive children (Davis et al. 2007), or an attention control condition, referred to together as Project Play. Project Play the feasibility of the after-school interventions for children with ADHD and DBD living in a high poverty community; examined whether EF benefits of aerobic activity apply to children with ADHD and DBD; and determined the extent to which the intervention influenced children's behavioral functioning and academic performance. This pilot randomized controlled trial (RCT) is intended to launch a program of research examining physical activity interventions as one component of coordinated mental health promotion efforts in underprivileged communities.

A. Specific Aim 1: Feasibility

To determine the feasibility of implementing Project Play for 6-12 year-old children with ADHD and DBD living in an urban poor community.

1. Hypothesis 1 – Feasibility

Program feasibility will be evidenced by a 75% retention rate, weekly attendance greater than or equal to three days/week, and heart rate monitor (HRM) records reflecting ≥ 40-min/day of physical activity at ≥ 75% of maximum heart rate (%MHR). Post-intervention focus groups will reflect strong program satisfaction among both parents and children.

B. Specific Aim 2: Impact

To determine the impact of Project Play on EF, behavioral functioning, and academic performance in 6-12 year-old children with ADHD and DBD living in an urban poor community.

1. Hypothesis 2a – Primary Outcome

The treatment condition will demonstrate statistically significant improvements from baseline to post-intervention relative to the attention control condition on the primary outcome measure, the Global Executive Composite (GEC) score of the Behavior Rating Inventory of Executive Function (BRIEF) (Gioia et al. 2002).

2. Hypothesis 2b – Effect Sizes

The intervention will yield small-medium effect sizes between conditions reflecting greater improvements in the treatment condition relative to controls on objective measures of EF (i.e., inhibition and working memory), behavior (by classroom observation, teacher-report, parent-report, school disciplinary records), and academic performance (by curriculum-based math and reading samples and school academic records).

3. Hypothesis 2c - Exploratory Analyses

Exploratory analyses will reveal individual baseline characteristics (i.e., age, gender, diagnosis, symptom and impairment severity, comorbid disorders, medication status, household characteristics, and baseline physical fitness levels) and participation indicators (i.e., attendance and average % maximum heart rate) that moderate the impact of the intervention in 6-12 year-old children with ADHD and DBD.

III. METHODS

A. Experimental Design

This RCT investigated the feasibility and impact of an after-school physical activity intervention for 6-12 year-old children with ADHD and DBD living in an urban poor community. Children were randomized to a physically active (treatment condition) or sedentary (attention control condition) after-school program referred to together as Project Play. The current study aimed to reach a 75% retention rate, weekly attendance greater than or equal to three days/week, and heart rate monitor (HRM) records reflecting ≥ 40-min/day of physical activity at ≥ 75% of maximum heart rate (%MHR) to demonstrate program feasibility. Post-intervention focus groups were conducted with participating parents and students to assess program satisfaction. Pre-post dependent measures of impact spanned the domains of EF, behavioral functioning, and academic performance. Adherence measurement occurred through attendance and HRM records.

B. Sample and Setting Characteristics

A sample of 56 children, 43 children meeting eligibility criteria and 13 non-disruptive siblings, 6-12 year-olds attending Robert Emmet Elementary School in Chicago's Austin community were enrolled in the current study (see Table I. Full Sample Participant Characteristics). Austin has high rates of poverty and few mental health resources. Of Emmet's 568 PreK-8th Graders, 99% are African-American and low-income (Illinois School Report Card: Emmet Elem School 2007). Accordingly, participants were 100% African-American, with 58% of parents reporting annual-household incomes below $10,000 per year and 43% of parents reporting less than high school education. The majority of parents were unmarried and the average number of children in the household was reported at slightly over three.

In order to recruit and enroll a sample of children with ADHD and DBD, two recruitment

Table I. Full Sample Participant Characteristics[a]					
Characteristics	**Total (N = 56)**	**Attention Control (N = 27)**	**Treatment (N = 29)**	***t* or χ^2**	***P* Value**[a]
	No. (%) or M (SD)	**No. (%) or M (SD)**	**No. (%) or M (SD)**		
Demographics	*n* = 56	*n* = 27	*n* = 29		
Child Age (yrs)	9.23 (2.00)	9.00 (2.00)	9.45 (2.01)	-0.84	.407
Male Gender	36 (64.3%)	16 (59.3%)	20 (69.0%)	0.57	.449
African-American	56 (100.0%)	27 (100.0%)	29 (100.0%)	-	-
Latino Ethnicity	2 (3.6%)	1 (3.7%)	1 (3.4%)	0.00	.959
Parent marital status					
Unmarried	39 (83.0%)	23 (82.6%)	25 (83.3%)	0.98	.806
Married	8 (17.0%)	4 (17.4%)	4 (16.7%)		
Number of children in home	3.28 (1.31)	3.26 (1.39)	3.29 (1.27)	-0.08	.937
Annual household income					
$0 - $10,000	25 (58.2%)	13 (61.9%)	12 (54.5%)	4.51	.342
$10,001 - $20,000	9 (20.9%)	4 (19.0%)	5 (22.7%)		
$20,001 - $30,000	6 (14.0%)	2 (9.5%)	4 (18.2%)		
$30,001 - $40,000	3 (7.0%)	2 (9.5%)	1 (4.5%)		
Parent employed	18 (38.3%)	8 (34.8%)	10 (41.7%)	0.24	.627
Parent highest education					
Less than high school	19 (43.2%)	8 (38.1%)	11 (47.8%)	0.44	.802
High school graduate	17 (38.7%)	9 (42.9%)	8 (34.8%)		
Some college	8 (18.2%)	4 (19.0%)	4 (17.4%)		
College/university grad	0 (0.0%)	0 (0.0%)	0 (0.0%)		
Graduate/professional	0 (0.0%)	0 (0.0%)	0 (0.0%)		
Past Year After-School Program Use[b]	*n* = 47	*n* = 23	*n* = 24		
Not at all	13 (27.7%)	5 (21.7%)	8 (33.3%)	2.70	.609
Once or twice	1 (2.1%)	0 (0.0%)	1 (4.2%)		
About once/week	11 (23.4%)	7 (30.4%)	4 (16.7%)		
Two or three Days/Week	7 (14.9%)	3 (13.0%)	4 (16.7%)		
Four or more day/week	15 (31.9%)	8 (34.8%)	7 (29.2%)		
Mental Health Service Use	*n* = 48	*n* = 23	*n* = 25		
Seen a Mental Health Provider	7 (14.6%)	4 (17.4%)	3 (11.5%)	0.34	.559
Medication for mental health	5 (10.4%)	3 (13.0%)	2 (8.0%)	0.33	.568
Non-disruptive Comorbidities	3 (6.3%)	2 (7.4%)	1 (3.4%)	3.10	.376
Parent/Teacher Disruptive Behavior Disorders (DBD) Rating Scale[c, d]	*n* = 54	*n* = 25	*n* = 29		
ADHD Inattentive					
Symptoms endorsed	3.81 (2.95)	3.56 (3.22)	4.03 (2.75)	-0.59	.561
Symptom severity	1.29 (0.82)	1.20 (0.86)	1.36 (0.79)	-0.68	.501
Criteria met	18 (33.3%)	8 (32.0%)	10 (34.5%)	0.04	.847
ADHD Hyperactive					
Symptoms endorsed	3.33 (2.62)	3 (2.48)	3.62 (2.74)	-0.87	.391
Symptom severity	1.20 (0.76)	1.09 (0.67)	1.30 (0.83)	-1.03	.309
Criteria met	13 (24.1%)	4 (16.0%)	9 (31.0%)	1.66	.198
ADHD Combined					
Symptoms endorsed	7.15 (4.94)	6.56 (5.16)	7.66 (4.77)	-0.81	.422
Symptom severity	1.24 (0.72)	1.14 (0.69)	1.33 (0.74)	-0.97	.337
Criteria met	11 (20.4%)	4 (16.0%)	6 (20.7%)	0.00	.950
ODD					
Symptoms endorsed	3.13 (2.43)	3.08 (2.41)	3.17 (2.48)	-0.14	.891
Symptom severity	1.23 (0.70)	1.23 (0.71)	1.23 (0.71)	-0.01	.989
Criteria met	18 (33.3%)	7 (28.0%)	11 (37.9%)	0.60	.440
CD					
Symptoms endorsed	1.17 (1.68)	1.08 (1.14)	1.25 (2.05)	0.15[h]	.884
Symptom Severity	0.27 (0.26)	0.29 (0.24)	0.26 (0.28)	0.46[h,i]	.647
Criteria met	6 (11.3%)	3 (12.5%)	3 (10.3%)	0.06	.805
Comorbid	12 (22.6%)	4 (16.67%)	8 (27.59%)	0.89	.344
Parent/Teacher Impairment Rating Scale (IRS)[c]	*n* = 54	*n* = 25	*n* = 29		
Domains endorsed	3.30 (1.93)	3.28 (1.79)	3.31 (2.07)	-0.06	.955

Table I. Full Sample Participant Characteristics (continued)[a]					
Characteristics	**Total (N = 56)**	**Attention Control (N = 27)**	**Treatment (N = 29)**	***t* or χ^2**	***P* Value**[a]
	No. (%) or M (SD)	**No. (%) or M (SD)**	**No. (%) or M (SD)**		
Overall functional impairment	3.35 (2.17)	3.40 (2.00)	3.31 (2.33)	0.15	.881
Best Friend					
Yes	39 (73.6%)	18 (85.70%)	15 (68.20%)	1.00	.317
No	14 (26.4%)	3 (14.3%)	7 (31.80%)		
Diagnostic Interview Schedule for Children, Version IV – Parent Interview (DISC-IV-P)[d, e]	*n* = 49	*n* = 24	*n* = 25		
ADHD					
Positive diagnoses	22 (44.9%)	10 (41.75)	12 (48.0%)	1.14	.566
Intermediate diagnoses	13 (26.5%)	8 (33.3%)	5 (20.0%)		
ODD					
Positive diagnoses	13 (26.5%)	6 (25.0%)	7 (28.0%)	5.04	.080
Intermediated diagnoses	10 (20.4%)	8 (33.3%)	2 (8.0%)		
CD					
Positive diagnoses	5 (10.2%)	1 (4.2%)	2 (8.0%)	0.54	.764
Intermediate diagnoses	3 (6.1%)	3 (12.5%)	2 (8.0%)		
Comorbid[f]	14 (28.6%)	6 (25.0%)	8 (32.0%)	0.29	.588
Accelerometer-Measured Physical Activity (PA) Outside of the Intervention[f]	*n* = 23	*n* = 11	*n* = 12		
All Days					
Sedentary minutes /day	295.26 (61.13)	300.62 (69.70)	290.35 (54.80)	0.40	.697
Minutes of light PA/day	319.77 (57.69)	299.24 (52.12)	338.60 (58.12)	-1.70	.103
Minutes of MVPA/day	26.39 (12.54)	22.59 (10.99)	29.86 (13.30)	-1.42	.170
Minutes of MVPA in bouts/day	4.53 (5.68)	2.89 (4.63)	6.03 (6.33)	-1.64[h]	.117
Weekdays					
Sedentary minutes /day	296.09 (60.36)	305.46 (72.26)	287.50 (48.68)	0.71	.489
Minutes of light PA/day	22.27 (56.80)	301.03 (54.78)	341.74 (53.49)	-1.80	.086
Minutes of MVPA/day	27.53 (14.37)	24.78 (14.13)	30.05 (14.73)	-0.87	.392
Minutes of MVPA in bouts	4.87 (6.80)	3.77 (6.96)	5.87 (6.80)	-0.73	.473
Weekend days					
Sedentary minutes /day	350.04 (132.07)	345.10 (109.05)	353.57 (154.96)	-0.11	.919
Minutes of light PA/day	389.63 (154.21)	354.10 (50.61)	415.00 (200.22)	-0.54[h,i]	.600
Minutes of MVPA/day	35.63 (29.79)	25.70 (13.59)	42.71 (36.92)	-0.97	.353
Minutes of MVPA in bouts	9.67 (17.55)	3.20 (7.16)	14.29 (21.70)	-1.09[h]	.302
Progressive Aerobic Cardiovascular Endurance Run (PACER)			*n* = 21		
15-meter laps completed	-	-	12.67 (4.90)	-	-
Fitness level					
Level 1	-	-	7 (33.3%)	-	-
Level 2	-	-	12 (57.1%)		
Level 3	-	-	2 (9.5%)	-	-
Maximum Heart Rate, bpm	-	-	191.68 (12.52)	-	-
Body Mass Index (BMI)	*n* = 44	*n* = 25	*n* = 27		
Age/gender percentile	75.42 (23.91)	75.52 (23.83)	75.29 (24.67)	0.03	.975
Classification					
Underweight	0.00 (0.0%)	0.00 (0.0%)	0.00 (0.0%)	1.32	.517
Normal weight	21 (47.7%)	11 (44.0%)	10 (52.6%)		
Overweight	8 (18.2%)	6 (24.0%)	2 (10.5%)		
Obese	15 (34.1%)	8 (32.0%)	7 (36.8%)		

[a.] P-values reflect difference between Treatment and Control groups on *t*-test (continuous variables) or Chi-Square test (discrete variables)

[b.] Utilization of any after-school program other than Project Play in the past year

[c.] The higher value among parent and teacher reporters at baseline (if both parent and teacher baseline data were missing parent posttest data were imputed [n = 4]); disorder diagnostic criteria includes 2 or more domains impaired on the Impairment Rating Scale (IRS).

[d.] ADHD = Attention Deficit Hyperactivity Disorder, ODD = Oppositional Defiant Disorder, CD = Conduct Disorder

[e.] Negative = minimal symptoms across diagnoses; intermediate = diagnostic criteria not met, but symptoms and impairments present; positive = full DSM-IV criteria met; comorbid = Intermediate or positive diagnosis for ≥ 2 disorders

[f.] Multiple positive diagnoses

[g.] Data collected during the 3rd and 4th weeks of the intervention

[h.] Data log10(x) or log10(x+1) transformed

[i.] Data non-normal despite transformation, interpret with caution

procedures were undertaken simultaneously during the Fall of 2012: (1) Direct recruitment of parents at school events, and (2) a multiple gating procedure in which teachers recommended children they felt would derive the most benefit from a program aimed at improving classroom behavior (see Appendix E. Teacher Recommendation Form). The decision to include disruptive and non-disruptive siblings in the intervention was based on 3 major considerations: 1) many parents indicated that they were not willing to separate their children during after-school time; 2) Many families had multiple children meeting inclusion criteria and it seemed unethical to turn away students in need from interested families when we were not at capacity; and 3) we anticipated that inclusion of non-disruptive siblings would provide a help to staff in facilitating the program because these students could be used as behavioral models for their disruptive peers.

While all participants were screened using parent report of symptoms and impairment on rating scales, the criteria for inclusion in the current study is less stringent than the Diagnostic Interview Schedule for Children, Version IV, Parent Interview (DISC-IV-P). The DISC-IV-P had initially been planned as the inclusion criteria measure in the current study but was unfeasible due to high participant burden stemming from its duration and was instead collected as a baseline measure after enrollment. The DBD section of the DISC, takes 30-60-minute to complete per child, assesses behavior in multiple settings over four time periods, and requires cross-situational symptoms and impairment to be present prior to the age of seven (Section H, Subsection 6 of this Chapter for a more detailed description of the DISC). Nevertheless, including non-disruptive siblings, roughly half of participants met full diagnostic criteria for ADHD on the DISC-IV-P. An additional 25% of students met criteria for an intermediate diagnosis of ADHD on the DISC-IV-P, defined as, "full diagnostic criteria not met but substantial symptoms and impairment present." Therefore, among the full sample, a total of 71% of participants met criteria for either a positive or an intermediate diagnosis.

Roughly one-quarter of participants met criteria for ODD on the DISC-IV-P, and an additional one-fifth met criteria an intermediate diagnosis (47% total). CD was far less prevalent in this sample as only 10% of participants met criteria for a positive diagnosis and only 5% an intermediate diagnosis on the DISC-IV-P. Slightly over one-quarter of participants met criteria for a positive diagnosis on the DISC-IV-P across multiple disorders (ADHD, ODD, and CD), termed comorbid.

It is worth noting that the full sample, including disruptive and non-disruptive siblings, is presented above for the purpose of facilitating interpretation of results related to Specific Aim 1, investigating the feasibility, external validity, and continued refinement of the intervention (e.g., staff-student ratio, implications for behavior management strategies, etc.). However, in analyses associated with Specific Aim 2, impact, only one child with ADHD and/or DBD from each family was randomly selected for inclusion to maintain the integrity of the analysis (i.e., not violate the independence assumptions associated with statistical group comparisons).

C. Inclusion Criteria

1) Boys and girls between the ages of six and 12 enrolled at Robert Emmet Elementary School; 2) Parental consent and child assent; 3) Free of developmental, orthopedic, or muscular disorders that preclude aerobic activity; and 4) A diagnosis of ADHD, ODD, or CD based upon eligibility screening (see Section 3.8.1), including parent and teacher symptom and impairment rating scales. Executive dysfunction is a core feature of ADHD and modestly associated with DBD (see Section 1.3); however, the current study included children with all three disorders. Children with DBD suffer from substantial impairments in behavior and academic functioning relative to non-disruptive peers and may benefit from interventions that improve functioning in these domains. Therefore, Project Play held promise for children with DBD to the extent that improvements in EF, in turn, improve behavioral and academic functioning (St Clair-Thompson and Gathercole 2006), including children with DBD whose EF profiles resemble those of their non-disruptive peers.

D. Statistical Power

Power analysis was based on the only available example, the first cohort of a study by Dr. Davis (R01-HL87923), in which overweight 8-11 year-old children were randomly assigned to a physically active after-school program or an attention control condition (the research design upon which the current study was modeled). Between-group effect size from baseline to post-intervention on the Global Executive Composite (GEC) Score of the Behavior Rating Inventory of Executive Function (BRIEF) was $d = 0.82$. Therefore, we based our sample size estimate on Cohen's large effect size or $d = 0.80$ (Cohen 1988). Assuming this effect size and a one-tailed alpha of .05, an estimated power of 0.80 was achieved with a sample size of 20 per group (n=40) (Cohen 1988).

E. Identification and Recruitment of Parents, Teachers, and Children with Attention Deficit Hyperactivity Disorder and Disruptive Behavior Disorders

This study took place at Robert Emmet Elementary School. Emmet Elementary has partnered with Dr. Stacy Frazier (Primary Sponsor) on studies since 2005. However, students from previous studies had been promoted to 7th grade or higher by the beginning of the current study, ensuring an uncontaminated sample. The current study utilized a modified multiple gating procedure to identify eligible students, which is more efficient than a school-wide screening and maintains the confidentiality of families choosing not to participate. Dr. Atkins' and Dr. Frazier's research team has used similar procedures in CPS schools previously. Accordingly, teachers recommended to school staff, the students in their classrooms they felt were most "struggling with their classroom learning and behavior." School staff then contacted parents of identified children to notify them of the research and ask whether they would like to have someone from the research team contact them to provide more information about the study. Contact information from parents/guardians requesting to be contacted were forwarded to the research team for follow-up, namely to provide more information, invite the parent to come in for eligibility screening, and informed consent and enrollment in the case that a students was eligible and

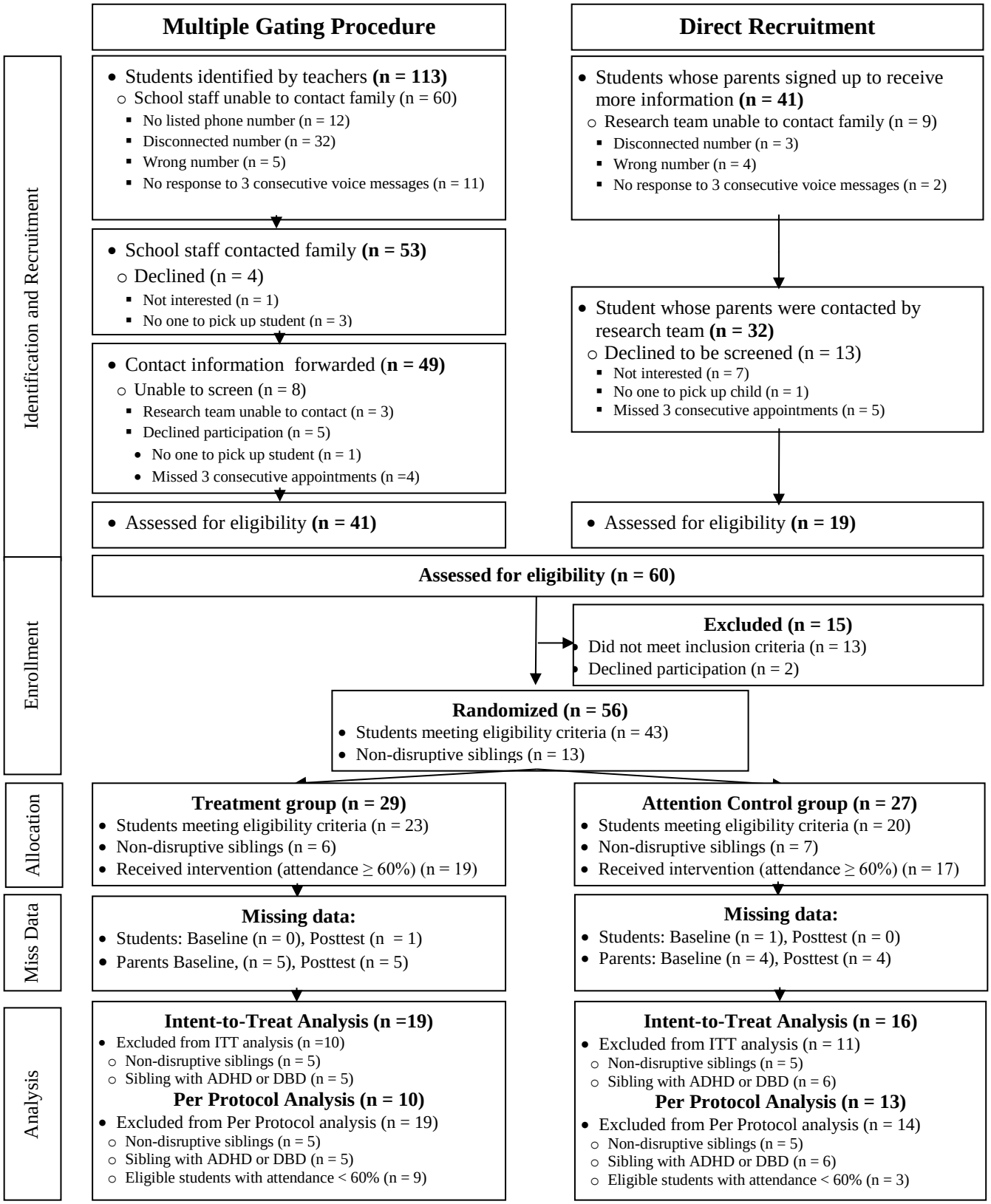
the family desired that he/she participate. Contact information from parents/guardians requesting not to be contacted was not forwarded to the research team (Loeber, Dishion, and Patterson 1984).

Figure II presents the Project Play Participant Flow Diagram. Briefly, in the current study, teachers recommended 113 students to school administrators during the Fall of 2012. Of these, contact information for the families of 49 students were forwarded to the research team by school staff. Research staff were able to reach 46 of these families, five declined to be screened, and 41 were screened for eligibility.

Concurrently, members of the research team set up recruitment tables at the school on report card pick-up day and during after-school pick-up time. This recruitment consisted of handing out flyers, talking to parents, and collecting contact information from interested families. This direct recruitment yielded 41 parents requesting more information. Of these, the research team was able to contact 32 families, 13 of whom declined to be screened. Therefore, 19 families were screened through the direct recruitment procedure for a grand total of 60 students assessed for eligibility.

Among the 60 students assessed, 13 did not meet inclusion criteria and two declined to participate. Hence, 43 students met criteria for ADHD and/or DBD. These 43 students from 35 families, and 13 of their non-disruptive siblings, were enrolled for a total sample of 56 students. In randomization, 29 students (23 disruptive students and 6 non-disruptive siblings) were randomized to the treatment condition and 27 (20 disruptive students and seven non-disruptive siblings) were randomized to the attention control condition. The study was presented to Project Play staff members and families as a study of the feasibility and impact of a single after-school program, Project Play, with two groups: a physical recreation group and an arts & crafts active groups.

Figure 2. Participant Flow Diagram



F. Procedures and Timeline

The dissertation timeline (see Table II. Dissertation Timeline) aligned with the Chicago Public Schools (CPS) Track E balanced academic calendar and took into consideration seasonal breaks. All participants were randomized to condition without regard to diagnostic status or other siblings enrolled in the study by Dr. Louis Fogg (Consultant) one-week prior to the intervention start date using software that utilized a list of pre-generated ID numbers and randomly assigned each ID to one of the two groups. Families then were contacted by the PI, informed of their child's group assignment and asked to provide appropriate clothing for the activity (e.g., sneakers for the physical recreation group and old shirts for arts and crafts in case the day's activities were messy) (Project Play Parent Handbook is available upon request).

Child baseline data collection began on-site during regular school hours (8:00am-3:15pm) on 12/10/12, 4-weeks prior to the intervention start date (1/7/13). This initial push lasted for two weeks up until Winter Break on 12/22/13. Child baseline data collection resumed during regular school and after-school hours on the first day back at school, which coincided with the first day of the intervention (Monday, 1/7/13). Child baseline data collection was completed during the first two weeks of the program with the exception of five students, three (two in treatment group, one in control group) were completed during the third week, one student in the treatment group enrolled in the study but missed the first four weeks of the program due to hospitalization. He was tested during the fifth week and completed the program. Finally, child data were not collected on one non-disruptive sibling in the attention control condition at baseline. Each child was tested one-on-one with a trained data collector in a quiet room. All data collectors were trained to reliability and blind to condition, and although data were collected after-school at both time points, participants in the treatment condition were only brought to the data collection room prior to the day's physical activity time to avoid confounding by acute

Table II. Dissertation Timeline

	Year 1: August 1, 2011 – July 31, 2012											
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
UIC IRB Process	*											
NIMH Grant funds received			*									
Start-up Activities: Meet with Emmet Elementary administrators and teachers, prepare data files, recruit staff, purchase supplies, and prepare Chicago Public Schools (CPS) Research Review Board (RRB) submission				*	*	*	*	*	*	*	*	*
Emmet Elementary Summer Break (6/18 – 8/10)											*	*
	August 1, 2012 – July 31, 2013											
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Emmet Elementary Summer Break (6/18 – 8/10)	*											
CPS RRB Review Approval Received	*											
CPS Chicago Teacher's Union Strike (9/12 – 9/19)		*										
Emmet Elementary Fall Break (9/25 – 10/12)		*	*									
Prepare for Data Collection and Intervention: Enroll Undergraduate RAs, train grad and undergrad RA instructors and data collectors		*	*	*	*							
Identify, Screen, and Recruit			*	*	*							
Baseline Data Collection (11/16 – 12/21)				*	*	*						
Emmet Winter Break (12/22/12 – 1/3/13)					*	*						
Randomization of Participants (12/14/12-1/3/13)					*	*						
Intervention (1/7/13 – 3/22/13)						*	*	*				
Emmet Elementary Spring Break (3/23 – 3/31)								*				
Post-Intervention Data Collection (3/8 – 4/12)								*	*			
Analyze Data, Interpret Data, and Write									*	*	*	
Dissertation Defense											*	
Dissertation Alterations and Completion												*

effects of physical activity. At each time point, child measures took no longer than 50-minutes and children received a small prize for completing them. Additionally, each child received a granola bar and glass of water at the beginning of testing to avoid confounding by differences in blood glucose levels (Gailliot and Baumeister 2007).

Parent data collection also was conducted one-on-one in a private room. Study data collectors read questionnaires aloud to parents and recorded answers unless the parent specifically requested to complete the forms without assistance. Data collectors were trained to offer assistance to parents who appeared to be repeating their answers or contradicting themselves, both of which seemed to convey misunderstanding of the questions due to discipline-specific jargon (e.g., stereotyped motor behaviors). In this case, the data collector was instructed to restate the question in plain language and offer an example.

Parent baseline data collection and student classroom observations began in November as soon as parents began signing up through direct recruitment. Parent baseline data collection was completed prior to the beginning of the intervention, with the exception of nine parents who did not attend baseline data collection appointments with study staff following eligibility screening and enrollment. Parent measures took no longer than 90-minutes per child at baseline. Parents were compensated $5 for completing eligibility screening, and $15 per baseline child packet completed. Due to limitations in staff availability and access to classrooms for observations only 27 45-minute classroom observations were completed at baseline.

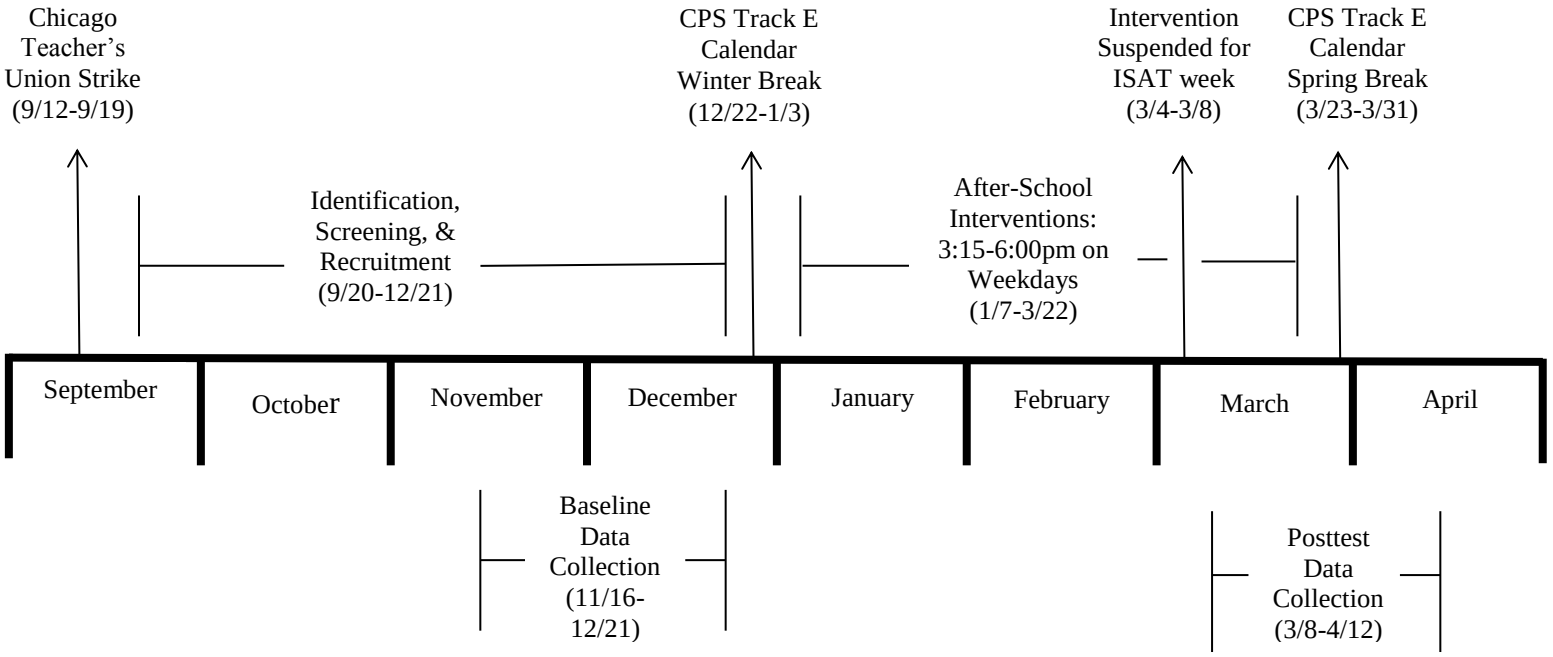
Packets were distributed to 11 teachers prior to winter break but only two teachers completed baseline packets for their students. A second packet with only the Parent/Teacher DBD Rating Scale and Impairment Rating Scale was distributed during the second week of the intervention and this packet received a better reception with five additional teachers completing and returning this set of packets for

19 students total. Teachers were reimbursed with $10 worth of school supplies of their choice for each child packet completed.

The intervention was planned to last for 12-weeks. The CPS 2012-2013 Track E Balance Calendar provided only one time during the entire school year in which students were in school for 12 consecutive weeks (1/7/13 – 3/31/13). Indeed, the intervention was delayed to take advantage of this window. Unfortunately, circumstances beyond our control or the control of the school administration shortened the intervention to 10-weeks of physical activity over an 11-week period (see Figure III. Intervention Timeline).

First, in September of 2012 a strike by the Chicago's Teacher's Union (CTU) pushed the date of spring break forward to 3/23/13, a shift that we weren't made aware of until halfway through the intervention, which shortened the program to 11-weeks. A second setback occurred on Friday of the intervention's 8th week when we were informed that the CPS administration had suspended all after-school programs in the Austin Community for the following week, due to the Illinois Standardized Achievement Test (ISAT). This shortened the program to 10-weeks, and took a full week out of the program with only three weeks remaining. We scrambled to inform parents and children in the physical recreation group to exercise for at least one hour each day over the ISAT week. However, it seems unlikely that this occurred given the limited opportunities to participate in physical activity in March in the Austin neighborhood and the more immediate stressors facing the families in our study. It is possible that some fitness effects were lost during that week, although they may have been regained in the final two weeks. An additional consequence from these reductions in intervention duration was that the staff rotations (described in Section 3.7.3), which had been scheduled to split staff time equally at 6-weeks with each group, were unbalanced such that each instructor team spent 4-weeks with one group and 6-weeks with the other.

Figure 3. Intervention Timeline



Child posttest data collection (neuropsychological tasks and classroom observations) began two weeks prior to the end of the intervention period (3/11/13). Again all activities were completed one on one with a data collector in a quiet room. Neuropsychological testing was completed for all but two students prior to the end of the program on (3/22/13), which also coincided with the CPS Track E Calendar Spring Break. Of the two remaining students one completed testing the week after spring break and the second refused to complete posttest data collection. Again, all children were reimbursed with a small prize for completing measures.

Classroom observations at posttest were completed for all students for whom parental permission for observations had been obtained by the second week of April, with the exception of two students in the treatment group and two students in the control group from the same classroom who initially had been observed during class playing academic games on iPhones and whose observations were redone during the 3rd week of April.

Parent posttest data collection began after the students returned from Spring break on April 1st. Again, parents met with a data collector one-on-one in a quiet room. Parent posttest data collection was completed by the second week of April for all but nine parents, who did not come in to complete posttest measures. Parents received $10 for completing posttest measures. A third set of packets were distributed to teachers at posttest containing only the BRIEF (the main outcome measure in the current study) but no teachers completed this posttest questionnaire.

G. Description of Intervention

Participants in the after-school intervention, Project Play, met in separate classrooms on weekdays at Robert Emmet Elementary School. Their daily schedule appears in Table III.

Table III. After-School Intervention Daily Schedule		
Time	**Treatment Group**	**Attention Control Group**
3:15pm-3:30pm	Transition Time and Snack	Transition Time and Snack
3:30pm-4:15pm	Homework/Tutoring	Homework/Tutoring
4:15pm-4:30pm	Transition Time	Transition Time
4:30pm-5:30pm	Physically Active Play	Physically Inactive Play
5:30pm-6:00pm	Free Play / Wrap-up	Free Play / Wrap-up

1. Behavior Management Strategies

The Project Play treatment and control interventions were based on interventions utilized by Dr. Catherine L. Davis (consultant) in her SMART Study (R01-HL87923) in overweight children. In order to increase the feasibility of the intervention for children with ADHD and DBD, a series of behavior management strategies were added equivalently to each group. Each strategy was evidence-based and had been utilized previously in after-school programs in Chicago urban poor communities through a research study conducted by Dr. Frazier in collaboration with the Chicago Park District (CPD) entitled Project NAFASI (Nurturing All Families through After School Improvement) (R01 MH081049). In this case, the behavior management strategy was tailored for the purposes of the study by the PI and two clinical child psychologists, Drs. Frazier and Rusch (consultant), and continually refined throughout the intervention by the PI and Project Play staff in consultation with Drs. Frazier and Rusch.

First, four basic rules were provided: 1) Respect people, places, and things, 2) Be where you are supposed to be, 3) Follow directions; and 4) Participate with a positive attitude. These rules were reviewed at the beginning of each day. Children in both groups made posters for the rules, signed them, and traced their handprints onto them. The posters were posted on the walls each day.

Second, a token economy in which students could earn tickets towards prizes was connected to the four rules. A board was created for each group entitled “Prize Board.” The board contained a series

of felt pockets labeled each with the name of a single student. Each pocket was filled with four popsicle sticks. Each time a child broke a rule a popsicle stick was removed. If the child had any sticks left at the end of the activity he/she would earn the full amount of tickets for that period. This process was followed twice each day, once during homework time, and once during play (aerobic exercise or art) time.

Third, the Good Behavior Game (GBG) (Embry 2002; Tingstrom, Sterling-Turner, and Wilczynski 2006), a group contingency-based behavior management system was used to promote rule-following behavior. The game consisted of a board displaying a large number of stars (twice as many stars as there were students in the group), and one large orange star directly in the middle. The game was played twice per day, once during homework time and once during structured play. At the beginning of each game the lead instructor announced that the game was beginning, would last for 10-minutes (a duration we adapted in the fourth week, described below), that each time a rule was broken a star would be removed, and that as long as the large orange star was left on the board the group would win a reward.

Through three weeks of the program these behavior management strategies were largely ineffective and during the fourth week were substantially modified in consultation with Drs. Frazier and Rusch. In part, the difficulty was due room changes, two staff rotations in the first month, and ongoing baseline data collection during the first two weeks of the program, but more than that the behavior management strategies were simply clumsy, confusing, cumbersome, and disjointed.

The GBG was largely ineffective because the children didn't value the prizes (e.g., picking a game to play) and didn't pay attention when staff announced that stars had been pulled or even that they had won the game after 10-minutes. During the fourth week of the intervention the GBG was relabeled the Pizza Party Game and an undergraduate staff member created two cardboard pizzas out of delivery

boxes. Each student had their name written on a single piece of cardboard pepperoni or sausage topping with velcro glued to the back. Each day that the group won the Pizza Party Game, a single pepperoni or sausage was added to the pizza. When all the names were added to the pizza the group won a pizza party. This generated much more buy-in for the GBG, especially after the first pizza party had been earned (the students initially accused us of lying and did not believe that we would actually throw them a pizza party if they won).

An additional problem was that the simultaneous use of the GBG for the first 10-minute of the homework and structured play periods followed by the token economy thereafter was too confusing and cumbersome for both students and staff. Therefore the pizza game and token economy/prize board were integrated into one game that occurred twice each day, but for longer and more natural durations, once throughout the 45-minutes of homework time and once throughout the hour of structured play. The integration was such that if a child broke a rule a staff member would pull a stick (reducing the child's tickets) and pull a star (threatening the group's pizza party) simultaneously.

This approach was much clearer and using them throughout the period provided excellent consistency and peer pressure for better behavior. Staff were also instructed to approach individual students who were going to have a star and stick pulled and to tell them that they were getting a star and stick pulled, what rule they had broken, and redirect them to what they were supposed to be doing. This was far more effective than trying to announce to the entire group that a star or stick was being pulled, especially when they were engaged in activities.

These adaptations were highly effective but still further adaptations were necessary to engage the most difficult students. Through daily dialogue, weekly meetings, and consultation with Drs. Frazier and Rusch we implemented seven additional strategies in week four. First, our most impulsive and hyperactive students almost always immediately lost all of their sticks because their capacity to adhere

to the rules was so limited. After the first two prize days the students were highly invested in earning tickets and when these students lost all of their sticks in the first 5-minutes of the day they had no incentive to follow the rules and their behavior was at its worst and often sabotaged the entire group. A simple adjustment addressed this effectively and easily, students were allowed to earn back sticks with good behavior once they had lost all their sticks. This was not announced to the group but instead was negotiated individually between the lead instructors and the student that had lost their sticks. It provided an excellent incentive for good behavior since ending with just one stick still earned full tickets. The second change was the flip side of earning sticks back. The rules were altered such that if a student had perfect behavior (no sticks pulled) they got double tickets for that period. This provided incentive for better behaved children not to lose two or three sticks at the end just for entertainment's sake.

The third and fourth adjustments, addressed serious challenges, related to bullying, hitting, and tantrums. First, a number of our children had great difficulty with emotional control and were prone to outbursts and tantrums if they felt slighted or didn't get their way. In part, these were failures of inhibition but in part they were adaptive behaviors in a context where bullying is prevalent. Indeed, anecdotally, these same behaviors were often used during the school day among the school's 7th and 8th graders.

During the after-school program, conflicts often arose over small perceived slights and escalated quickly. In these instances staff followed protocol, separated students, and removed sticks and stars. Ultimately, however, this was insufficient. Once most students had been set off they simply could not calm themselves down when crammed in a classroom with 20+ other children and their continued misbehavior severely disrupted activities.

In order to address these challenges we created a detention room, which was supervised by a staff member at all times. The staff member would escort the student to the room where they could calm

themselves down. There was no talking allowed in detention and it saved group activities on many days by allowing staff to keep one or two children from sabotaging them. In fact, many children learned to ask to go to the detention room to calm themselves down when they felt themselves getting out of control.

Second, we adopted and adapted the offense contract system used by Davis et al. (2007, 2011). This system provides a five-strike system beginning with a warning and culminating in expulsion (see Appendix G. Project Play Offense Contracts). Offense contracts were reserved for more serious violations, such as, cursing, bullying, and hitting, and disrespecting staff, peers, or materials. Offense contracts each automatically resulted in loss of all tickets earned and all play time for that day. The first offense was a written warning that students had to sign stating that they had lost their tickets and play time for the day and that their parents would be notified if there were another offense contract. The second had the same consequences, required a parent's signature, and warned the student that a third offense would lead to an automatic one day suspension. The third and fourth carried the same consequences, required the parent's signature, and were accompanied by suspensions of one-day and one-week respectively. The fifth offense led to expulsion. For our purposes hitting or attempting to hit automatically led to the remainder of the day in detention and an automatic one-day suspension in addition to the offense contract.

Because some of our children struggled so heavily with their behavior and we wanted to keep them in the program, all students that reached a fourth offense had a meeting with their parent(s) and the PI during which the PI offered the student the opportunity to earn back a strike with five days of good behavior as determined by the Graduate Lead Instructor for their group. Offense contracts were largely for emotional tantrums, outbursts, and hitting. Students detested being suspended, begged to be let back in, and usually tried to sneak back in during their suspensions. With the exception of two students, all

the rest who reached four strikes seized the opportunity to earn back strikes after their fourth and successfully completed the program.

The fifth adjustment to the program was a result of adaptive deviance on the part of the younger children. Because there were only four to five staff per room on a given day the students learned that they could break us down quickly if one or two of them would "run the halls." Usually, this was first or second graders who would dart out of the classroom and essentially play hide and seek with the staff. The staff had to follow them because elementary school children cannot be left unsupervised for liability reasons. From the child's perspective this was great fun, they were free from the constraints of their desk after having been tied to one all day, they were getting individual attention from the staff, and they got a great adrenaline rush from refusing repeated requests to come back in the room. However, from a staff perspective if one child was being recovered in the halls and another staff was escorting students to the bathroom or retrieving supplies then the staff-student ratios in the room became highly unfavorable with two staff paired with 20+ students. From there, activity engagement dropped, and eventually the room itself became out-of-control (high volume, rule-breaking, etc.) and this trickled down to overcrowding in detention, high levels of offense contracts, suspensions, less exposure to the intervention, and more negative feedback to the child and their parents.

To prevent this domino effect we adapted a strategy we titled the "Project Play Zone Defense." One staff member was already charged with facilitating the pizza game / prize board while the others led activities and played games with the students or assisted them with their homework. A small adjustment was made in that this staff member was charged with "owning the door" and would stand in front of the door and physically block it with their body and the large frame which held the prize board with the popsicle sticks. Essentially, on the frequent daily occasions in which a small child approached the door and said, "I gotta run the halls," they were redirected to the activity at hand. In the event that children

did escape and run the halls which of course occurred since all a child had to do was say they needed to us the bathroom, the staff member at the door would walky-talky a designated staff member whose role was dubbed, "The Hawk." The staff member would provide The Hawk with the name of the child and their location and it was the duty of that staff member to bring that child back to the room, usually after a short detention. On days where school staff and security were present they assisted with this role. A premium in this strategy was put on keeping the core of the staff in the room facilitating engaging activities with the majority of students to prevent misbehavior at all times.

The aforementioned changes, especially the offense contract system, had the effect of drastically reducing misbehavior but also led to some drop in morale, especially among older students, and even among parents who were suddenly hit with a stream of negative feedback regarding their child's behavior. We adapted by implementing Star of the Day (SOD) and Good News Notes (GNN) (Project Play Parent Handbook available upon request). These were simple interventions that we had intended to use from the start and trained on but did not utilize at the beginning of the program because there were so many fast-paced changes occurring simultaneously at that time, and it felt too much to ask of the staff but integrating these small notes made all the difference in the world.

Each day staff chose and distributed one to two SODs to individuals in each group who excelled for the full day. The SOD was only a piece of paper with a picture of a star on it, the name of the student, and a brief description of what they excelled at that day, but it's scarcity, the fact that it was only given to one student each day made it highly desirable. SOD was reserved for students who were on-task and went above and beyond to be helpful. SOD were also accompanied by a substantial reward of 10 tickets in the token economy in addition to other tickets earned that day through the regular token economy mechanisms. If a child was SOD they had by definition had a good day, so children who won SOD usually ended the day with a ream of tickets.

For students who constantly get negative feedback regarding their behavior during the school day, whose parents get called into the school because they have been fighting, have low grades, and are generally told they are bad, to come down the hallway towards their parents with a big colorful star in one hand and a ream of tickets in the other put a huge smile on their faces and the faces of their parents. The staff were instructed to make as big a deal as possible out of it (while remaining genuine), asking the child what they had, asking them to read to their parents what they had done to win the award. The more difficult the child was the more celebratory the announcement. Indeed, for students who only gave us one good day in 10-weeks, the day that they won SOD was a full-on event with screaming staff, hugs, and congratulations. Parents informed us later that some of the students actually took their SODs and taped them above their beds.

GNN served a similar function but were given out more liberally. They were especially helpful tools for staff who understood that even though they would never get a full good day out of a student, progress would only come if they could reward the good behavior when they saw it. For these most difficult students the GNN allowed the staff to reward if they did just one good thing (e.g., 10 good minutes of math homework, 30-sec. where they helped a younger student tie his/her shoe, shared a snack with a friend). GNNs won students an additional five tickets that day and ultimately, the impact was similar to an SOD. A child walking toward their parents with a GNN, especially one who is accustomed to delivering mostly bad news to their parents, has the same look of pride on his/her face as a child walking with an SOD.

This combination of adjustments in conjunction with continual refinement of details such as, making the water cooler off limits to students, placing academic supplies on tables prior to child arrival, ensuring at least one male staff member in each room at all times, having staff members stuff their pockets with sharpened pencils, dismissing the best behaved table to go to the gym first, ensuring that a

staff member was awaiting their arrival in the gym with warm-up activities immediately available, were highly effective and remained that way through the duration of the program.

2. Treatment Condition

Children in the treatment condition participated in a modified version of The Play Project intervention utilized by Davis et al. (2007; 2011) (The Play Project exercise activities are available upon request). The treatment group consisted of homework time in a classroom followed by structured aerobic play in the school gymnasium, followed by free play contingent upon completion of homework and participation in the structured PA activities. Active play was comprised of a variety of cooperative and competitive games and modified sports aimed at maximizing participation and aerobic expenditure (Gutin et al. 1999; Turner and Turner 2000). A salient feature of this program is that while a group game is ongoing in the center of the room, supervised aerobic play equipment (e.g., trampolines, jump ropes, and hula hoops) around the periphery enable children to maintain activity as they await their next turn. Unfortunately, during the fifth week of the intervention we scaled down this feature because too many children were using it as a tool to not participate in the structured activities and cause mischief on the periphery.

Instead, we only brought in materials for the aerobic activities that were going to be played and made popular activities, such as basketball and dancing, during free play (the last half-hour of each day) contingent upon universal participation in the aerobic activities (either a group game in the center or a series of stations throughout the gym) for 60-minutes. The free play was an especially valuable hook for older students because the students could participate in the activity of their choice. During the program's third week, children were given a one-button heart rate monitor (HRM) and taught how to use it. During that week children received tickets in the token economy (see section 3.7.1) simply for wearing and returning the HRM. During each week thereafter children earned tickets contingent upon returning their

HR monitor to a staff member with higher HR values receiving higher ticket values (see Appendix F. Daily Attendance and Ticket Logs).

3. Attention Control Condition

Children randomized to the Attention Control Condition participated in a comparable after-school intervention, including behavior management strategies, a group activity in the center facilitated by a staff member (e.g., charades or a group art or craft), and individual alternatives along the periphery (e.g., cards, puzzles, board games), even staff rotated so that children were exposed to the same staff members as their peers in the treatment group. There were two main differences between groups: First, during the structured play time, children in the attention control group participated in sedentary play activities only. Second, in addition to earning tickets through good behavior in the same proportion as the treatment group, the attention control group could earn tickets for participation in the arts and crafts activity (Accuracy/Creativity, Use Supplies Correctly, Clean Up after Yourself) in proportion to what the treatment group could earn through high HR. The reward schedule was periodically checked and slowed or excelled to result in equal allocation of tickets between groups.

4. Instructors

After-school instructors were five graduate students and eight undergraduate students enrolled at the University of Illinois at Chicago (UIC). It is worth noting here that we initially hoped to recruit staff members from UIC's pool of undergraduate and graduate Psychology students since the children had mental health disorders, however, after multiple recruitment attempts in this pool did not yield any interest we moved on to other health professions. We also hoped to enlist more men as staff at the request of the school administration and understanding that ADHD and DBD are more prevalent in boys than girls. However, among the nearly 100 applicants only a handful were men. Despite this deviation from the original grant proposal we ended up with an excellent staff. All instructors had experience and

interest in working with children and came from diverse professional and personal backgrounds (see Appendix A. Project Play Staff Bios). Staff received daily supervision and support from the PI, weekly group meetings, and periodic consultation from two child psychologists, Dr. Stacy L. Frazier and Dr. Dana Rusch (see Appendix D. Dissertation Committee Members and Consultants).

Instructors received 16-hours of training on study activities and behavior management strategies during December, 2012 with the PI and Dr. Rusch. Trainings focused on conceptual issues related to behavior management and were adapted from trainings led by Dr. Frazier's research team throughout Chicago Park District (CPD) sites across the city. Sample themes included, utilizing simple and clear rules and instructions, using "do" as opposed to "don't" commands, catch 'em being good, be proactive not reactive, give attention to the behaviors you want to see, ignore behavior you don't want to see, prepare engaging age-appropriate activities (by definition children cannot be engaged in the activity and simultaneously misbehaving). Training also focused on specific instruction in study behavior management techniques, such as the good behavior game (GBG), token economy, SOD, and GNN. In each case, the concepts were reviewed and practiced through role play, with time allocated afterwards for feedback and discussion. Ongoing daily supervision and support concerning study activities and behavior management strategies continued once the program started, and weekly staff meetings provided opportunities to review the week, plan for the upcoming week, troubleshoot problems, and seek consultation from Drs. Marquez, Rusch, and Frazier.

Within each group, staff had highly specialized roles, which were held constant across groups. Two graduate and two to three undergraduate staff facilitate each group at all times, for a staff-to-child ratio between 5.6 to 1 and 7 to 1 on days with full attendance, but usually less than that. Three strategies were used to minimize confounding by instructor characteristics or behaviors, including attention. First,

each staff was matched as evenly as possible between in-terms of qualifications and experience working with kids.

Second, staff in both conditions had equivalent, specific roles. A Graduate Lead Instructor facilitated group activities, coordinated staff in the room, kept activities on schedule, and ensured transitions went smoothly and activities were prepared. A second Graduate Instructor facilitated the GBG and token economy (by praising rule following, withdrawing sticks and stars for rule breaking, and "owning the door"). Two to three undergraduate assistants were then responsible for circulating the room and helping students with homework, encouraging active participation in periphery activities through positive reinforcement and redirecting misbehavior as necessary.

Finally, staff rotated between groups four times: Rotation 1 - Weeks 1-2 (two weeks), Rotation 2: Weeks 3-4 (two weeks), Rotation 3: Weeks 5-8 (four weeks), Rotation 4: Weeks 10-11 (two weeks) (week nine of the program was cancelled due to ISAT and week twelve was cancelled due to rescheduling spring break). Staff rotations turned out to be a double-edged sword, the first rotation led to considerable dismay among students, who fought to keep the staff members they had bonded with. Other students were excited to have time with staff they had heard about from friends and siblings though, and ultimately the overall group accepted the explanation that we wanted them to be exposed to all the different college students not just some of them and took comfort in the knowledge that the staff would be switching back soon. Subsequent staff rotations were less impactful as the students developed relationships with both instructor teams.

From an internal validity perspective this maneuver makes the data more interpretable and an unintended benefit was that each team developed a few nuances during their times with each group which were later adopted by the incoming team when they rotated back. It also led to groups being able to provide better feedback to counterparts during troubleshooting meetings. After rotating staff twice in

the first month and struggling with behavior, in part, due to a variation of a substitute teacher effect, we decided to abandon the bi-monthly rotations and execute as few additional rotations as possible in the remaining weeks while keeping the exposure to each staff team equivalent across groups. Unfortunately, this goal was somewhat undermined by the unexpected loss of weeks during the intervention.

H. Description of Measures

A single primary outcome, the Behavioral Rating Inventory of Executive Function (BRIEF), and nine additional exploratory dependent measures spanned three domains: EF (three measures), behavioral functioning (five measures), and academic performance (two measures). Additional data were collected on feasibility and baseline characteristics and participant indicators. Data collection was conducted exclusively at Emmet School by graduate research assistants (RAs) blind to condition. Training and reliability checks were conducted in accordance with recommendations articulated in the references associated with each measure.

1. Eligibility Screening

Disruptive Behavior Disorders (DBD) Rating Scale (Baseline) (Pelham, 1992) lists the DSM-IV criteria for ADHD, ODD, and CD on a 4-point Likert scale from "not at all" to "very much." Three factors correspond to the three diagnoses (alphas .96, .95, .76, respectively) (Pelham et al. 1992). Eligibility in the current study was operationalized as meeting criteria for ADHD inattentive type, ADHD hyperactive type, ODD, or CD based on symptom count (the number of symptoms endorsed as "Pretty Much" or "Very Much") in conjunction with impairment in at least one domain on the IRS. Symptoms severity was calculated as described by Sibley et al. (2011) who summed scores across scales (0 = not at all, 1 = just a little, 2 = pretty much, 3 = very much) and divided the total by the number of items on the scale (Sibley et al. 2011). At baseline, the ADHD Inattention Symptom scale reliability was

good at α = .87, as was the ADHD Hyperactivity/Symptoms subscale at α = .85, the ODD subscale reliability was questionable at α = .65, and the CD overall subscale was acceptable at α = .77.

Impairment Rating Scale (IRS) (Baseline) (Fabiano, 2006) assesses the severity of a child's impairment and need for treatment and services across a variety of domains. Raters place an X on a line that signifies the child's placement on a continuum of impairment. The measure has exhibited strong reliability and validity (Fabiano et al. 2006). Children were deemed eligible for the current study if their parent rated them as impaired at intake (score ≥ 3) in any domain in conjunction with the meeting criteria for the DBD rating scale.

The eligibility criteria utilized is less than the diagnostic criteria used in the DSM-IV in that we accepted students with impairment in only one domain instead of two. However, the vast majority of students met criteria in two or more domains. Students bordering but not meeting diagnostic criteria but who still experience high symptom levels and substantial impairment in some domain still have need and are still on the continuum of the disorders of interest. The decision was made easier by the fact that we did not reach capacity for program participation, and therefore their inclusion did not push out students meeting full diagnostic criteria for ADHD and DBD.

2. Feasibility

Focus Groups Post-Intervention Focus Groups were conducted separately with 12 parents with at least one child in the treatment group and their children using the procedure described in Morgan and Krueger (1998) (Morgan and Krueger 1998). Focus group feedback was audiotaped and moderator debriefs were transcribed verbatim by the PI. The PI then reviewed transcripts and generated preliminary themes and associated quotes for presentation in table form using a variation of the long table approach with special attention given to frequency, specificity, emotion, and extensiveness of responses (Krueger and Casey 2000). In future investigations of this data, multiple raters will be used,

full transcripts will be transcribed and coders will come to consensus on aspects of the program that participants enjoyed, those they did not, and those in need of change.

Heart Rate Monitors (HRM) were used in the current study to encourage physical activity in the treatment group and to monitor treatment fidelity. HRMs were Polar FT1 one-button models paired with Polar T-31 Coded chest straps. This HRM starts and stops recordings by touching the single button one-time and outputs three values: average HR, maximum HR, and duration. Participants in the treatment condition were asked to hit the button one-time together as a group at the beginning of each exercise period and to refrain from hitting it again until the HRM was collected by a staff member, values recorded, and tickets were distributed based on output.

In order to view one's HR averge, max HR, or duration without stopping the recording one had to touch the watch to the chest strap without hitting the button. Raw HR data in beats per minute (bpm) were transformed to an individualized percentage of maximum heart rate (%MHR), determined in the PACER test (see Subsection 6 of the Measure's Section below for a description), in the current study to better represent intensity since there may be differences in maximal HR between individuals.

Accelerometry (Tyron & Williams, 1996) PA was monitored with portable triaxial accelerometers (Tryon and Williams 1996). Accelerometers provide a valid assessment of PA in children in free-living conditions (Ainsworth et al. 2000; Hendelman et al. 2000) and can be used to estimate frequency and intensity of activity (Mathie et al. 2004). Two models were used, first the GT3X which requires selection of an epoch interval, one-minute was selected in the current study. 1-minute epoch intervals were selected in the current study despite recommendations that children require 1-sec. to 15-sec. epochs to capture their sporadic and brief outbursts of vigorous physical activity (Trost et al. 2011). However, this error is conservative (it will underestimate MVPA in kids) and is not differentially distributed between groups. The second monitor type, GT3X+ collects and reports data in raw form and

offers the option to transform the data to any desired epoch. Therefore, this data can be transformed and altered into any epoch length. For the purposes of this analysis, the GT3X+ raw data were transformed to 1-minute epochs to stay consistent with the GT3X data and maximize sample size. The monitors were distributed to students between the 3rd and 4th weeks of the study.

Data were included in analyses only if ≥ 10 hours of data were available in a 24-hours period, for at least 3 days (Trost, McIver, and Pate 2005). Nonwear-time was defined by periods of ≥ 20 minutes of consecutive zero counts (Stevens et al. 2007; Treuth et al. 2003). Accelerometer output were analyzed utilizing Evenson (2008) cutpoints (Sedentary: ≤ 100, light PA: >100, Moderate PA: ≥ 2296, Vigorous PA ≥ 4012) (Evenson et al. 2008), which were endorsed for use in children in a recent comparative validity study (Trost et al. 2011).

3. Executive Function

STOP-IT Task (Verbruggen & Logan, 2008) is an automated computer task that measures response inhibition. The task instructs participants to respond as fast as possible to a stimulus and then later to inhibit that response when a stop signal is presented (Verbruggen, Logan, and Stevens 2008). On each trial, a square or circle is presented. Subjects are instructed to hit the z-key each time they see a square and hit the /-key when a circle appears, and to do so as quickly as possible. The exception to this rule is that when a beep, a "stop-signal," sounds then the participant must try to inhibit themselves from touching any key. The stop-signal occurs on 25% of trials, randomly dispersed, and at different delays termed the Stop-Signal Delay (SSD), based upon how successfully the participant inhibits their responses.

It is easier to inhibit your response when the stop-signal comes quickly after seeing the shape so if a participant correctly inhibits their response on one trial, the program will delay the stop-signal for 50-msec. making it more difficult to successfully inhibit their response. If the participant fails to inhibit

their response the program will then give the stop-signal 50-msec. earlier. This continues over 4 blocks (a practice box of 32 trials and 3 experimental blocks of 64 trials), with a 10-second break between blocks until the program precisely identifies the SSD at which the individual successfully inhibits 50% of the time, termed, *p*(respond|signal) (Verbruggen, Logan, and Stevens 2008). The SSD at the 50% *p*(respond|signal) is used to calculate stop-signal reaction time (SSRT), which reflects the time that it takes to internally suppress a response, is highly correlated to a myriad of other inhibition measures, distinguishes between ADHD and non-ADHD children via performance differences that are ameliorated with methylphenidate (Diamond 2013; Aron et al. 2003).

A caveat here is that if the final *p*(respond|signal) number is significantly different from 50% then the data are not interpretable, which led to a number of participants' data being excluded in the current trial.

Automated Working Memory Assessment System – Short Version (Alloway et al., 2007) provides four fully automated measures of verbal and visuospatial working memory that have been standardized and evidence strong construct validity (Alloway et al. 2009). The first, Digit Recall, measures verbal short-term memory. In this test the individual hears a sequence of digits and attempts to recall each sequence in the correct order. The score is determined by the highest number of digit sequence recalled in correct order prior to failing consecutively.

The second task, Listening Recall, measures verbal working memory storage and processing. In it the individual hears a series of individual sentences and judges if each sentence is true or false (e.g., "bicycles have ears" = false, while "magazines have pages" = true). At the end of the trial, the individual attempts to recall the final word of each sentence in correct order (i.e., ears and pages). This test yields two scores: (1) a score for responding true or false correctly to each sentence – called processing and (2) a score for recalling the final word in each sentence.

The third task, Dot Matrix, measures visuospatial short-term memory. In it the individual is shown the position of a red dot in a series of four by four matrices and attempts to recall this position by tapping the squares on the computer screen. The final score is based upon how many blocks the participant is able to correctly touch in the correct order before failing in consecutive trials.

The final task, Spatial Recall, measures visuospatial working memory. In it the individual views a picture of two shapes where the shape on the right has a red dot above it. The individual identifies whether the shape on the right is the same or opposite of the shape on the left. The shaped with the red dot may also be rotated. At the end of each trial, individual attempts to recall the location of each red dot on the shape, in the correct order by pointing to a picture with three possible positions marked. Again, the individual receives two scores, the first, for identifying whether the shape with the red dot was the same or opposite as the shape on the left (processing) and a second score for correctly recalling the position of each dot in sequence.

Behavioral Rating Inventory of Executive Function (BRIEF) (Gioia, 2002) is a parent and report-teacher of real-world manifestations of EF. Standardized scales include initiation, inhibition, shifting, monitoring, planning, organization, working memory, and emotional control. The initiate, working memory, plan/organize, organization of materials, and monitor scales are combined to create a Metacognition Index (MI). The inhibit, shift, and emotional control scores are combined to create a Behavioral Regulation Index (BRI). The combination of these indices is used to create the Global Executive Composite (GEC) score, which was the main outcome in the current study. The BRIEF possesses strong psychometric properties, has been used with children with ADHD and DBD (Gioia et al. 2002). An important note for interpreting results is that lower scores on the BRIEF are adaptive. At baseline, the inhibit ($\alpha = .91$), shift ($\alpha = .82$), emotional control ($\alpha = .87$), initiate ($\alpha = .78$), working memory ($\alpha = .88$), plan/organize ($\alpha = .88$), organization of materials ($\alpha = .80$), and monitor ($\alpha = .71$)

subscales all evidenced reliability between acceptable and excellent. The same was also true for the BRI (α = .87), MI (α = .87), and GEC (α = .82).

4. Behavioral Functioning

Social Skills Improvement System (SSiS) (Gresham, 2008) assesses child functioning in a Social Skills Scale, Problem Behaviors Scale, and Academic Competence Scale by parent and teacher report. Subscales provide raw scores and behavioral level (0 = below average, 1 = average, 2 = above average) only and include seven items in the Social Skills Scale: Communication, Cooperation, Assertion, Responsibility, Empathy, Engagement, and Self-Control; and 5 Subscales in the Problem Behaviors Scale: Externalizing, Bullying, Hyperactivity/Inattention, Internalizing, and Autism Spectrum. It is psychometrically strong (Gresham and Elliott 2009). On the Social Skills Scale and its subscales higher scores are considered adaptive while on the Problem Behaviors Scale and its subscales lower scores are considered adaptive. At baseline, reliability for the 2 scales was good to excellent: Social Skills Scale (α = .87) and Problem Behaviors Scale (α = .90). Among SSiS subscale reliabilities, Communication (α = .20) and Self-Control (α = .42) were unacceptable; Assertion was poor (α = .55); Cooperation (α = .60), Responsibility (α = .66), and Autism Spectrum (α = .60) were questionable; Empathy (α = .72), Engagement (α = .70), Externalizing (α = .73), Bullying (α = .74), and Hyperactivity/Inattention (α = .74) were acceptable; and Internalizing was good (α = .85).

Behavioral Observation of Students in Schools (BOSS) (Shapiro, 2004) is an observation tool that uses momentary time sampling to measure levels of on- and off-task behavior. Teacher-directed instruction is scored every fifth interval along with peer comparison data. Inter-observer kappas range from .93-.98 for children with ADHD (Ota and DuPaul 2002; DuPaul et al. 2004). BOSS discriminates between children with and without ADHD (Shapiro 2004) and has been used in Dr. Atkins' and Dr. Frazier's prior intervention work (R01-MH073749 PI: Atkins, Co-I: Frazier).

Disruptive Behavior Disorder (DBD) Rating Scale (Pelham, 1992) is described above and was used as both an eligibility screener and a dependent variable.

Impairment Rating Scale (Post-Intervention) (Fabiano, 2005) is described above was used as both an eligibility screener and a dependent variable.

5. Academic Performance

Curriculum Based Measurement (CBM) (Shapiro, 1996) was used to examine oral reading fluency (R-CBM), reading comprehension (Maze), and math computation (M-CBM). Research staff scored three 1-minute samples of each child's reading for Correct Words and Errors Per Minute (R-CBM), a 3-minute sample of reading comprehension operationalized as circling a single correct word out of groups of three words dispersed throughout the reading (Maze), and a 4-minute sample of children's math work for number of correct digits (M-CBM). CBM-R and CBM-M have demonstrated strong psychometric properties in previous research (Burns et al. 2000).

6. Potential Moderators

National Institute of Mental Health Diagnostic Interview Schedule for Children Version IV (NIMH DISC-IV-P) (Shaffer, 2000) The NIMH DISC-IV is a structured diagnostic interview designed to assess child and adolescent psychiatric disorders. Only the disruptive disorders section of the parent interview (DISC-P) was utilized in order to control cost and participant burden. The DISC-P has strong validity, acceptability, and reliability (Shaffer et al. 2000). It can be administered by "lay" people with training and allows for exclusion of modules that are not relevant to a particular study (Shaffer et al. 2000).

Progressive Aerobic Cardiovascular Endurance Run (PACER) (Mahar et al., 1997) assesses aerobic fitness. Children ran across a 15-m space at a specified pace, increasing in speed each minute, for as long as they were able to keep pace. The testing was conducted one-on-one in the current study

because of difficulty in getting the group to successfully complete the task as a whole. The PACER score represents the number of laps completed prior to failing in consecutive laps. Times categorize children into one of three fitness levels and to determine MHR (Mahar et al. 2010; Mahar et al. 1997).

Demographics were measured by questionnaire at baseline and included parent marital status, employment, number of children in household, race/ethnicity, child gender, age, and after-school program use, medication status, and seeing a mental health professional.

Attendance, disciplinary, and behavior management data Each day staff completed an attendance and ticket log, in which they recorded who was present, how many tickets they earned and for what, what HR values they achieved, and whether they earned an SOD or a GNN (see Appendix F. Daily Attendance and Ticket Log). Simultaneously, the PI collected data on number of offense contracts, suspensions, and days suspended along with the reasons for punishment.

Posttest measures Questionnaires were included in posttest parent child packets and asked whether children had participated in any other after-school programs over the course of the study, whether there had been any change in medication status or other major events, and whether they could correctly identify their child's random group assignment. The blind was measured with a single item, which asks which group their child was in and provided 3 options: a) physical recreation, b) arts & crafts, or c) don't know.

I. Data Analyses Associated with Aims

1. Specific Aim 1: Feasibility

To determine the feasibility of implementing Project Play for 6-12 year-old children with ADHD and DBD living in an urban poor community.

Hypothesis 1: Program feasibility will be evidenced by an 75% retention rate, weekly attendance ≥ 3 days/week, and heart rate monitor (HRM) records reflecting ≥ 40-min/day of physical activity at ≥

75% of maximum heart rate (%MHR). Post-intervention focus groups will reflect strong program satisfaction.

Program feasibility was explored as study retention rate, average attendance, and heart rate monitor (HRM) records average daily percentage of maximum heart rate (%MHR) and duration. These data were looked at for all participating students, including disruptive siblings and non-disruptive siblings. Post-intervention focus groups also were conducted and preliminarily analyzed for program satisfaction themes and potential changes to improve the program in the future.

2. Specific Aim 2: Impact

To determine the impact of Project Play on EF, behavioral functioning, and academic performance in 6-12 year-old children with ADHD and DBD living in an urban poor community.

Hypothesis 2a: The treatment condition will demonstrate statistically significant improvements from baseline to post-intervention relative to the attention control condition on the primary outcome measure, the Behavior Rating Inventory of Executive Function (BRIEF) (Gioia et al. 2002).

Hypothesis 2b: Exploratory analyses will yield small-medium effect sizes between conditions reflecting greater improvements in the treatment condition relative to controls on measures of EF (i.e., working memory, attentional vigilance, and inhibition), behavior (by classroom observation, teacher-report, and parent-report), and academic performance (by curriculum-based math and reading samples).

Hypothesis 2c: Exploratory analyses will reveal individual baseline characteristics (i.e., age, gender, symptom severity, comorbid disorders, medication status, and physical activity and fitness levels) and participation indicators (i.e., attendance, % maximum heart rate, and fitness improvement) that are associated with change scores on EF measures in 6-12 year-old children with ADHD and DBD in bivariate correlation analyses.

Independent *t*-tests and chi-square tests were initially conducted between groups on baseline characteristics, program participation indicators, and baseline outcome measures to address any initial differences between groups. For all measures, linear mixed effects models were performed with three base factors: group (0 = control, 1 = treatment), time (1 = baseline, 2 = posttest), and the interaction of group and time (group*time-1). This approach was chosen over an ANOVA in the current study primarily due to its advantages in handling missing data at each time point (Bliese 2009) and efficiently and reliably addressing multiple comparisons (Gelman, Hill, and Yajima 2009). Only statistically significant differences ($p \leq .05$) between groups on the group x time interaction are interpreted. Variables that were significantly different between groups at baseline were then entered into models as covariates for outcome variables that reached significance.

As a pilot study with a relatively small sample the current study also calculated effect sizes (within and between groups over time) and bivariate correlations between participation indicators (e.g., attendance) and change scores for all outcomes of interest. Within group effect sizes, Cohen's *d*, were calculated as treatment posttest value – treatment baseline value change divided by pooled standard deviation. Between group effect sizes, also Cohen's *d*, were calculated as treatment group change – control group change divided by pooled standard deviation (Wilkinson; 1999). Cohen's *d* serves as a standardized metric for improvement obtained through the intervention for each outcome variable independent of sample size (Cohen 1988). A positive sign was assigned to values corresponding to adaptive change or change in favor of the treatment condition and a negative sign was assigned to values corresponding with maladaptive change or change in favor of the attention control condition.

In order to preliminarily explore potential moderators we examined the bivariate correlations between suspected moderators of interest such as age, gender, impairment, and symptom severity and change scores across outcomes. All analyses associated with Aim 2 initially used an intent-to-treat

approach, with only one child with ADHD or DBD from each family randomly selected for inclusion in analyses by study statistician Dr. Fogg. Intent-to-Treat analyses were followed by per-protocol analyses for children attending greater than or equal to three days per week and the same siblings excluded as in intent-to-treat analyses.

All outcomes analyzed in the current study were continuous with the exception of two: 1) whether the child had a best friend as reported on the parent IRS (0 = No, 1 = Yes), and 2) the subscales of the SSiS. The latter reports both a continuous unadjusted raw score and an ordinal behavioral level adjusted for age and gender (0 = below average, 1 = average, 2 = above average). The best friend question on the IRS was not analyzed for between group differences, while the ordinal behavioral level output from the SSiS subscales were treated as continuous in analyses. The latter decision diverges from the analytical approach chosen by a previous physical activity intervention among ADHD children (Kang et al. 2011), which analyzed and interpreted unadjusted raw scores on the SSiS subscales. However, our decision is based on sound evidence that ordinal variables with 3 or more levels can be effectively treated as continuous variables (Agresti 1984) and the fact that behavioral level outcomes are standardized for age and gender while raw scores are not, and are therefore, less interpretable in between group comparisons in a study such as ours, which includes both genders and a broad age range. In any case, interpreting the standardized behavioral levels is the more conservative test of the two (lower probability of Type-1 error) due to the smaller range of quantitative values in SSiS subscale behavioral levels (0-2) relative to the SSiS subscale raw scores (0 to 16).

J. Instruction in the Responsible Conduct of Research

During the fall of 2012, the PI enrolled in the UIC course, GC 401. This 14-week course met NIH requirements for formal training in the responsible conduct of research by reviewing ethical and legal issues in the conduct of research. Also, the PI completed the UIC CITI Training Refresher Course

annually. Finally, weekly meetings with Drs. Frazier and Marquez were used to discuss relevant human subjects issues.

IV. RESULTS

A. Specific Aim 1: Feasibility

Indicators of feasibility in the current study included enrollment, retention, attendance, HRM records (see Table IV. Full Sample Program Participation Indicators), and participant focus group data (see Table V. Child Focus Group: Preliminary Themes, Table VI. Parent Focus Group: Preliminary Themes, and Appendix H: Focus Group Moderator Debrief Transcripts). An 80% retention rate was set as the goal and that was exceeded with 50 students completing the program (89%). Unfortunately, three students were expelled and three withdrew over the 10-weeks (10%). Attendance goals were established in the proposal as greater than three out of five days per week (60%), an exercise frequency level that has yielded cognitive benefits in a previous study (Verret et al. 2012). Project Play achieved an attendance rate of 63% (65% in control and 61% in treatment), including the six students who were expelled or withdrew.

Reasons for absences were broad. On average, students were suspended through offense contracts for 2.4 days over the course of the program (see Table IV). Among three students withdrawing from the program, two in the treatment group withdrew in the first week and a third, also in the treatment group, was withdrawn in the eighth week after his brother was expelled from the control group. Among three students expelled, one in the treatment group was expelled in the fourth week, one in the control group was expelled in the seventh week, and a final student was expelled from the control group during the program's final week.

A handful of classroom teachers offered sedentary after-school tutoring programs on Tuesday, Wednesdays, and Thursdays and nine participants (six in treatment and three in control) were simultaneously enrolled in these programs for one to three days per week at the discretion of their parents. Unfortunately, two students, one in each group, missed days due to psychiatric hospitalization, a student in the control group missed days because she had to babysit a younger sibling and a final student

Table IV. Full Sample Program Participation Indicators					
	Total (N = 56)	**Attention Control (N = 27)**	**Treatment (N = 29)**	***t* or χ^2**	***P Value*[a]**
	No. (%) or M (SD)	**No. (%) or M (SD)**	**No. (%) or M (SD)**		
Participation Indicators	*n* = 56	*n* = 27	*n* = 29		
Attendance	0.63 (0.24)	0.65 (0.19)	0.61 (0.28)	0.70	.486
% Attending more than 60%	36 (64.3%)	17 (63.0%)	19 (65.5%)	0.04	.842
Withdrew from study	3 (5.4%)	0 (0.0)	3 (10.3)	2.95[g,h]	.086
Heart Rate Monitors (HRM)			*n* = 25		
Daily avg. HR, bpm[b]	-	-	141.32 (14.79)	-	-
Daily avg. %MHR[c]	-	-	0.74 (0.05)	-	-
Daily avg. high HR achieved, bpm	-	-	193.11 (8.76)	-	-
Daily avg. high %MHR achieved	-	-	1.01 (0.06)	-	-
Daily avg. HR duration, minute	-	-	28.83 (13.16114)	-	-
Physical Activity During After-School Intervention[d]	*n* = 23	*n* = 11	*n* = 12		
Minute of sedentary activity/day	44.00 (14.68)	45.53 (13.50)	42.61 (16.16)	0.47	.644
Minute of light PA/day	82.64 (13.59)	86.72 (14.93)	78.90 (11.62)	1.41	.174
Minute of MVPA/day	18.18 (12.73)	16.02 (12.04)	20.17 (13.55)	-0.99[g]	.334
Minute of MVPA in bouts/day	7.15 (9.86)	5.39 (7.56)	8.78 (11.68)	-0.86[g]	.397
Behavior Management Strategies	*n* = 56	*n* = 27	*n* = 29		
Good News Notes awarded per student	0.88 (0.85)	0.89 (0.70)	0.86 (0.99)	0.12	.908
Stars of the Day awarded per student	1.68 (1.63)	1.74 (1.68)	1.62 (1.61)	0.28[g]	.784
Tickets earned per student	258.16 (126.26)	263.37 (107.73)	253.31 (143.13)	0.30	.769
Pizza parties through GBG, No.[e]	4	2	2	-	-
Offense contracts per student	2.07 (1.93)	2.26 (1.95)	1.90 (1.93)	0.70	.488
Days suspended per student	2.43 (3.44)	2.52 (3.51)	2.34 (3.43)	0.34[g,h]	.733
Expulsions	3 (5.4%)	2 (7.4%)	1 (3.4%)	0.43[g,h]	.511
Potential Confounders	*n* = 56	*n* = 27	*n* = 29		
Enrolled in other program simultaneously	9 (19.6%)	6 (26.1%)	3 (13.0%)	1.24	.265
Major adverse events, No.	1	0	1	-	-
Psychiatric hospitalization, No.	2	1	1	-	-
Police arrests, No.	4	1	3	-	-
Change in medication	0 (0.0%)	0 (0.0%)	0 (0.0%)	-	-
Parent correctly identified random group assignment[f]	14 (29.8%)	3 (13.0%)	11 (45.8%)	6.04	.014

[a] *p*-values reflect difference between Treatment and Control groups on independent samples *t*-test (continuous variables) or Chi-Square test (discrete variables)

[b] BPM = beats per minute

[c] %MHR = % Max Heart Rate, calculated as average HR divided by individual MHR as determined by the Progressive Aerobic Cardiovascular Endurance Run (PACER)

[d] Accelerometer output from 3:30-6:00pm between Monday and Friday during the third week of the program for students that wore the accelerometer for 3 days at least 10-hrs. per day

[e] GBG = Good Behavior Game

[f] Blind measured at posttest

[g] Data log10(x) or log10(x+1) transformed

[h] Data nonnormal despite transformation, interpret with caution

Table V. Child Focus Group: Preliminary Themes

Common Themes	Quotes
Project play was fun	"It's hard work but its fun."
The students liked the staff members	"I like the staff." "What I like about Project play is that when I come in they tell me to sit down and help me with my homework; that's how I got all As and Bs on my report cards and that's why I want it to come back." "I like all the staff in project play because they are funny and they like teach us how to do more stuff, like multiplications and more sports and more games." "They teaching me self-respect"
The students would have liked less talking and misbehaviors during homework time	"In project play they interrupt you while you trying to do your homework and stuff."
The older kids did not like being with the younger kids	"I don't wanna play with no little kids except for her." "I think y'all should have all the older kids in the gym... The little kids should be upstairs." "Little kids, when we talking bout conversations, the little kids don't know what we be talking about; they be like huh, what you say, what was that, what was this?" "Some younger kids bad, you all need to go to military school."
The younger kids did like being with the older kids	"I got friends in the older kids though, second grade." "I like [older student], that's my friend, her and (inaudible), her is my friend." "I like everybody as my friend."
The kids liked that they had the ability to win prizes for good behavior	"At the end of the day if you had sticks left you could get a prize."
Project Play helped them in the classroom	"I started to talk a lot more [in class]"
Students feel Project Play has helped their behavior at home and with peers	" …at first I was being bad but now like I don't do the stuff that I did, like running the halls and stuff." "I usually try to kill my sister but now I don't" "I use to be mean to people, they would act stingy and I would act stingy, but now [after project play] it's not like that; when somebody act stingy I still give em something… just cause they do it don't mean you don't have to." "I use to be talking bad but now I'm not"
Some of the students thought that the staff could have been more tolerant of the students	"They need to be more patient."
Students felt activities were redundant and boring	"They (the staff) need to do better activities." "We be playing the same things over and over again and we already know how to play it." "[Going over the same rule] makes me frustrated and mad." "The gymnastic group should have had volleyball." "There should have been painting"
The students thought that the tickets for the prizes were too high	"You all should have lowered the number of tickets for the basketball cause 500 tickets for a basketball, because it was name-brand…." "A little bitty camera was 200 tickets; really?!"
The kids wanted to be able to switch between groups	"Some of the arts-and-craft kids should go to the gym and some of the gym kids should have gone to arts-and-craft."
The students thought that there should be more punishment	"The only reason you should get kicked out is for cursing or being disrespectful." "It should be one strike and you're out."
If project play was offered again the students all said that they would come back	"[I would come back to Project play] because of Mr. [X]." "Mr. [X] is the nicest [staff] in the whole program."

Table VI. Parent Focus Group: Preliminary Themes

Common Themes	Quotes
Parents liked the social, interactive, and structured nature of Project Play and felt their children benefited	"My son really liked being in Project Play and I really thought that was a good idea for him to be interactive with different you know activities…I liked it." "I really liked Project Play because it brought a lot out of my boys that I didn't know" "At first he [my son] wasn't one to interact with other kids, but now he interacts with other kids and he just loves kids now, but at first he didn't like kids at all." "My boys will participate again because they got a lot out of it [Project Play]" "There were lots of activities that my kids enjoyed" "I liked the program overall; it gave em something to do instead of them at home eating all day and watching Disney a lot, cause that's what they do." "He was with other kids, some older some younger, and he's an only child so it uh, really did help him interact with other children and experience being around other older and younger children."
Project Play served as helpful child care and kept kids off the streets	"It (Project Play] was good cause at least it kept them off the streets for a little bit." "The program was good for him [my son] it gave him something to do you know, it gave me a break, cause he active…overall I think the program was good; he needed that [Project Play]. I wish it was still going on cause now he comes straight home from school, you know, I gotta deal with that." "I think after school programs is really good for the kids, cause that saves them from getting into any trouble on the streets and hearing about them on the news, they can be in afterschool from 3:30 to 6 o'clock and you ain't got to worry about 'oh that's my child, my child just got shot or something.'
Project Play posed challenges for non-disruptive siblings enrolled in the program who were exposed to the behaviors of their disruptive peers and were targets for bullying	"You know, there are some kids that are better than other kids, and that could cause a problem because now they're getting into that atmosphere of, now how do I handle this; you know what I'm saying, I don't want to get into trouble but I don't wanna get punked." "My kid was getting more aggressive, getting into more fights." "Auntie, every time, this boy in second grade and third grade keep picking on me, keep picking on me…he became bad because of that bully that kept messing with him." "Sometimes the same kids that's bullying them during the school day is in their after-school program."
The program taught children how to play constructively	"With this program, I liked it [Project Play] because it shows them [the kids] how to respect each other and get along and don't judge each other, you have to talk to a person to get…you just can't say, oh I don't like her, but I don't know her." "They [the kids] learned different ways of playing with each other instead of being violent."
The staff members were great	"I like it [Project Play] because the co-workers [staff] that were there were of different nationality. I liked it." "Some staff were very, very good." "In Project Play they let them be themselves; they did have to put on no front. They didn't have to try to fit in, they let them be themselves."
The program was too short and they wish it was year-round	"They just closed this building down; they closed the school; it could be opened up for Project Play!" "It [Project Play] was really good; I think they should bring it back. I'm just mad it was a little short. I just wish it was a little bit longer, cause I come and get my kids, they don't wanna go home. (laughter) I get here like 5:30 and I don't leave till 6:15-6:30." "[The program should start] from the time that school open to the time they close. And in the summer it could be available too! I think that would be great."

Table VI. Parent Focus Group: Preliminary Themes (continued)

Common Themes	Quotes
Project Play helped their children with their social skills	"My boys like it a lot. They liked to have their good notes, they liked the tickets, and I kept up with their each individual tickets, in clear bags, I put their little things in their bags and whatever." "When Project play came along he's like 'ma, we had so much fun, me and,' he used words that, he's 5-years-old saying, 'I interacted with this boy so good and we just played so nice and they gave me a good note.' Now he just know how to play with a child, cause at first he only played with his siblings, his brothers. He a child that he's so mean, but now he's just not as mean as he used to be. And he know how to come out and talk more. At first, he wasn't talking as much, now he just, he know how to make friends….I loved Project Play." "You can be apart from where you come from; you don't have to forget whether you come from, but you know, you can do better than what the other kids, you know…and that's what the program [Project Play] taught them."
Parents had mixed opinions about siblings being separated	"Three of my kids was upstairs together and then my younger was downstairs in general by herself; I don't think that was fair because, the downstairs in the gym was the ones that was getting into trouble all the time; she shouldn't have been down there at all."
Children learned to control their tempers	"I like that it [Project Play] taught them to use their anger and madness and put it into something productive." "He [staff member] showed then that 'you don't have to act like this, you're better than this' he be telling them, you don't have to act like this because this [other] child is acting up." "He be teaching them, you know, calm down, take a breather, think about your actions and your reactions and them come and talk to me." "That's the thing I liked about the program, it taught him to, you know, you don't have to take your anger out. You can go read a book, go take time, or go sit by yourself and just calm down." "Instead of my daughter fighting, instead of her getting mad, she put on her little headphone, she turned her music up, and she ballet through that whole house…after the program. Now before the program, boy, she'd grab her pair of scissors or a knife and try to cut you, yes she will; but now she put on her headphones, she put on her music, them little legs just go twirling around in the house and I ain't got no problem."
They liked that kids were given second chances	"Most programs would be like 'you have to go' but [staff member] would be like, look I'm a give you one more chance now I'm trying to work with you; calm down, you know you don't have to be so angry."
Academic improvements after Project Play	"My nephew's spelling improved a lot….and also [he's] reading real well." "My son [after the program] I say he went from a C to an A within three weeks in his math." "My son came home the other day with 4 spelling tests and all of them were a 100%."
Some Parents did not see improvements in behavior at home	"My kids were basically the same. I think if it [Project Play] was a little bit longer then maybe he [my son] would have been changed.'
Kids were so exhausted after the activities and would fall asleep early	"There were a lot of activities. [After they came home] when they took a bath, they ate, when they finish, I walk into my room, I come back out my room, when I say literally go into my room and come out my room, and I would look in their room, they would be asleep."
Lack of alternative programs	"They got a lot of summer camps but once they get full that's it. The camp gets full your child can't go. Say you got 3 kids, you get 2 that get into that camp and you coming with the third one, but ain't no room, so that child can't go; so I think all year round would be great."
The staff was not stern enough	"Just the situation that I seen with the little boy and [staff member; I don't think he was stern enough." "You have to be a little bit more firm with them [the kids] because a lot of them." "Sometimes if you are stern enough with kids, a kid could go home and tell his mama "yeah he yanked me or he did things to me, and then the parents are goanna come up her and go "ra ra…my child didn't do this" well how you know what your child did or didn't do?"
Stigma regarding mental health disorders	"I would never let anyone tell me my child has ADHD."

in treatment missed days because there was no one to pick her up at 6:00pm. An additional four students (two fifth graders in treatment and two sixth graders in control), simply chose not to attend regularly and had parental permission to go straight home after-school let out at 3:15pm. Among these, three tended to receive detention or offense contracts quickly when they did attend, which likely negatively influenced their experience of the program, while the fourth student expressed frustration that her friends had been randomized to a different group then her. Finally, on a few occasions students misbehaved during school hours and were either suspended from school, Project Play, or both for short periods of time.

In all, two-thirds of students attended more than three days per week and among students attending more than three days per week attendance rates were quite high. The per protocol analysis, which included 23 students from 23 families meeting eligibility criteria and attending greater than or equal to three days per week, revealed average attendance rates of 74% in controls and 81% in the treatment group with less than 1% standard deviation in each. The goal for daily average HR was set at 75% MHR, which was met in the full sample at 74% MHR average daily HR. Daily average maximum HR achieved for any single recording was 101% of MHR, indicating that the children participated in vigorous PA for moments but moderate throughout.

Post-intervention focus groups with (n = 12) parents and (n = 10) students revealed widespread program satisfaction with 100% of parents and students stating that they would reenroll if offered the opportunity. At the same time, parents and children also had legitimate concerns and suggested insightful alterations to improve future iterations of the program. Preliminary themes included that the program was too short and that they would like to see it brought back and extended year around. Parents found it convenient to have a program to watch their kids after school and felt that the kids made strides socially and emotionally. Children, on the other hand, focused on staff relationships and playing with other kids as their main motivation for participation. They also liked that the program gave prizes for good behavior and that staff worked with them specifically to help them grow and develop.

B. Specific Aim 2: Impact

1. Intent-to-Treat Analyses

Intent-to-treat analyses (ITT) are considered the gold standard for RCTs because they maintain the integrity of the randomization when participants drop-out or when adherence is poor (Montori and Guyatt 2011). They also provide a more accurate assessment of the outcomes a program is likely to achieve in the real world where drop-out and non-adherence are inevitable. In the current study ITT included children with ADHD or DBD regardless of their attendance rate. In cases where a single family enrolled multiple siblings with ADHD and/or DBD, one child from each family was randomly selected for inclusion in analyses by study statistician Dr. Fogg. This was done in order to maintain the integrity of the independence assumption in between group comparisons. The resulting subsample (n = 35) is described in Table VII. Intent-to-Treat Analysis: Partipant Characteristics and Table VIII. Intent-to-Treat Analysis: Measures Obtained During the Intervention.

Independent sample *t*-tests and chi-squared tests between groups on baseline participant characteristics identified significant differences between groups in number of children meeting DISC diagnostic criteria for ODD diagnosis (t = 7.97, p = .019) and for not meeting criteria for any disorder on the DISC (t = 4.31, p = .038), and trends for child having a best friend (χ^2 = 3.77, p = .052) and seeing a mental health professional (χ^2 = 3.72, p = .054). All were analyzed as covariates in the linear mixed effects model when significant dependent variables were identified. Similarly, independent *t*-tests between groups on participation indicators revealed a significant difference between groups in the number of parents that were able to correctly identify their child's group assignment (the blind) (t = 4.76, p = .029). This variable was added as a covariate in the model for outcomes reaching significance.

Table VII. Intent-to-Treat Analysis: Participant Characteristics[a]					
Characteristics	**Total (N = 35)**	**Attention Control (N = 16)**	**Treatment (N = 19)**	***t* or χ^2**	***P* Value[a]**
	No. (%) or M (SD)	**No. (%) or M (SD)**	**No. (%) or M (SD)**		
Demographics	*n* = 35	*n* = 16	*n* = 19		
Child Age (yrs)	9.09 (2.11)	8.69 (1.99)	9.42 (2.19)	-1.03	.312
Male Gender	24 (68.6%)	11 (68.8%)	13 (68.4%)	0.00	.983
African-American	35 (100.0%)	16 (100.0%)	16 (100.0%)	-	-
Latino Ethnicity	1 (2.9%)	1 (6.3%)	0 (0.0%)	1.22	.269
Parent marital status					
Unmarried	24 (85.7%)	11 (78.6%)	13 (92.9%)	3.00	.392
Married	4 (14.3%)	3 (21.4%)	1 (7.1%)		
Number of children in home	2.89 (1.29)	2.71 (1.14)	3.07 (1.44)	-0.73	.473
Annual household income					
$0 - $10,000	13 (52.0%)	7 (53.9%)	6 (50.0%)	5.27	.261
$10,001 - $20,000	6 (24.0%)	3 (23.1%)	3 (25.0%)		
$20,001 - $30,000	4 (16.0%)	1 (7.7%)	3 (25.0%)		
$30,001 - $40,000	2 (8.0%)	2 (15.4%)	0 (0.0%)		
Parent employed	13 (46.4%)	6 (42.9%)	7 (50.0%)	0.14	.705
Parent highest education					
Less than high school	10 (40.0%)	3 (25.0%)	7 (53.8%)	2.16	.339
High school graduate	10 (28.6%)	6 (50.0%)	4 (30.8%)		
Some college	5 (20.0%)	3 (25.0%)	2 (15.4%)		
College/university grad	0 (0.0%)	0 (0.0%)	0 (0.0%)		
Graduate/professional	0 (0.0%)	0 (0.0%)	0 (0.0%)		
Past Year After-School Program Use[b]	*n* = 28	*n* = 14	*n* = 14		
Not at all	8 (28.6%)	5 (35.7%)	3 (21.4%)	2.50	.645
Once or twice	1 (3.6%)	0 (0.0%)	1 (7.1%)		
About once/week	3 (10.7%)	2 (14.3%)	1 (7.1%)		
Two or three Days/Week	6 (21.4%)	2 (14.3%)	4 (28.6%)		
Four or more day/week	10 (35.7%)	5 (35.7%)	5 (35.7%)		
Mental Health Service Use	*n* = 29	*n* = 14	*n* = 15		
Seen a Mental Health Provider	6 (20.7%)	5 (31.3%)	1 (6.7%)	3.72	.054
Medication for mental health	4 (13.8%)	3 (21.4%)	1 (6.7%)	1.33	.249
Non-disruptive Comorbidities	3 (10.3%)	2 (14.3%)	1 (5.3%)	0.45	.501
Parent/Teacher Disruptive Behavior Disorders (DBD) Rating Scale[c, d]	*n* = 34	*n* = 15	*n* = 19		
ADHD Inattentive					
Symptoms endorsed	4.97 (2.60)	5.13 (3.07)	4.84 (2.24)	0.32	.751
Symptom severity	1.43 (0.76)	1.64 (0.79)	1.51 (0.71)	0.50	.620
Criteria met	16 (47.1%)	8 (53.3%)	8 (42.1%)	0.42	.515
ADHD Hyperactive					
Symptoms endorsed	4.03 (2.72)	4.00 (2.70)	4.05 (2.82)	-0.06	.956
Symptom severity	1.57 (0.73)	1.42 (0.65)	1.44 (0.85)	-0.09	.929
Criteria met	11 (32.4%)	4 (26.7%)	7 (36.8%)	0.40	.529
ADHD Combined					
Symptoms endorsed	9.00 (4.42)	9.13 (5.01)	8.90 (4.03)	0.15	.879
Symptom severity	1.49 (0.65)	1.51 (0.62)	1.47 (0.68)	0.18	.862
Criteria met	8 (23.5%)	4 (26.7%)	4 (21.1)	0.15	.702
ODD					
Symptoms endorsed	3.56 (2.48)	3.67 (2.61)	3.47 (2.44)	0.22	.825
Symptom severity	1.33 (0.72)	1.42 (0.76)	1.25 (0.69)	0.70	.488
Criteria met	15 (44.1%)	7 (46.7%)	8 (42.1%)	0.07	.790
CD					
Symptoms endorsed	1.25 (1.95)	1.14 (1.23)	1.33 (2.41)	0.24[h]	.810
Symptom Severity	0.29 (0.28)	0.31 (0.26)	0.27 (0.31)	0.45[h]	.653
Criteria met	6 (18.2%)	3 (20.0%)	3 (15.8%)	0.06	.805
Comorbid	10 (29.4%)	5 (33.3%)	5 (26.3%)	0.20	.656

Table VII. Intent-to-Treat Analysis: Participant Characteristics (continued)[a]					
Characteristics	**Total (N = 35)**	**Attention Control (N = 16)**	**Treatment (N = 19)**	***t* or χ^2**	***P* Value[a]**
	No. (%) or M (SD)	**No. (%) or M (SD)**	**No. (%) or M (SD)**		
Parent/Teacher Impairment Rating Scale (IRS)[c]	*n* = 34	*n* = 15	*n* = 19		
Domains endorsed	3.79 (1.68)	3.87 (1.69)	3.74 (1.73)	0.22	.827
Overall functional impairment	3.82 (1.96)	3.80 (1.82)	3.84 (2.12)	-0.06	.952
Best Friend					
Yes	21 (67.7%)	12 (85.7%)	9 (52.9%)	3.77	.052
No	10 (32.3%)	2 (14.3%)	8 (47.1%)		
Diagnostic Interview Schedule for Children, Version IV – Parent Interview (DISC-IV-P)[d,e]	*n* = 31	*n* = 15	*n* = 16		
ADHD					
Positive diagnoses	17 (54.8%)	9 (60.0%)	8 (50.0%)	1.94	.379
Intermediate diagnoses	9 (29.0%)	5 (33.3%)	4 (25.0%)		
ODD					
Positive diagnoses	9 (29.0%)	5 (33.3%)	4 (25.0%)	7.97	.019
Intermediated diagnoses	5 (16.0%)	5 (33.3%)	0 (0.0%)		
CD					
Positive diagnoses	1 (3.2%)	0 (0.0%)	1 (6.3%)	1.21	.546
Intermediate diagnoses	5 (16.1%)	3 (20.0%)	2 (12.5%)		
Comorbid[f]	10 (32.3%)	4 (26.7%)	6 (37.5%)	0.42	.519
Negative across disorders	4 (12.9%)	0 (0.0%)	4 (25.0%)	4.31	.038
Accelerometer-Measured Physical Activity (PA) Outside of the Intervention[f]	*n* = 13	*n* = 6	*n* = 7		
All Days					
Sedentary minutes/day	311.09 (66.42)	330.72 (71.35)	294.26 (62.17)	0.99	.346
Minutes of light PA/day	312.65 (63.46)	285.32 (62.90)	336.08 (58.05)	-1.51	.158
Minutes of MVPA/day	21.64 (9.28)	18.55 (8.62)	24.29 (9.62)	-1.12	.285
Minutes of MVPA in bouts/day	2.98 (4.10)	0.90 (2.68)	4.76 (4.44)	-1.93	.083
Weekdays					
Sedentary minutes /day	308.21 (65.55)	328.73 (75.07)	290.63 (55.83)	1.05	.317
Minutes of light PA/day	311.36 (61.82)	284.17 (64.55)	334.68 (52.90)	-1.55	.149
Minutes of MVPA/day	22.48 (10.26)	20.73 (9.74)	23.98 (11.22)	-0.55	.591
Minutes of MVPA in bouts/day	3.33 (4.83)	1.63 (4.00)	4.79 (5.28)	0.69[h]	.527
Weekend days					
Sedentary minutes /day	379.83 (152.72)	458.00 (70.71)	340.75 (176.34)	0.86	.436
Minutes of light PA/day	437.50 (213.75)	330.50 (86.97)	491.00 (249.35)	-.93[h]	.406
Minutes of MVPA/day	40.75 (39.37)	11.25 (3.18)	55.50 (41.35)	-1.43	.227
Minutes of MVPA in bouts/day	13.50 (23.66)	0.00 (0.00)	20.25 (27.40)	-1.70[h]	.187
Progressive Aerobic Cardiovascular Endurance Run (PACER)			*n* = 12		
15-meter laps completed	-	-	10.17 (2.98)	-	-
Fitness level					
Level 1	-	-	6 (50.0%)	-	-
Level 2	-	-	6 (50.0%)		
Maximum Heart Rate, bpm	-	-	188.10 (10.18)	-	-
Body Mass Index (BMI)	*n* = 26	*n* = 15	*n* = 11		
Age/gender percentile	76.30 (25.54)	72.27 (25.78)	81.79 (25.34)	-0.94	.358
Classification					
Underweight	0 (0.0%)	0 (0.0%)	0 (0.0%)	2.46	.292
Normal weight	11 (42.3%)	7 (46.7%)	4 (36.4%)		
Overweight	5 (19.2%)	4 (26.7%)	1 (9.1%)		
Obese	10 (38.5%)	4 (26.7%)	6 (54.5%)		

[a] P-values reflect difference between Treatment and Control groups on *t*-test (continuous variables) or Chi-Square test (discrete variables)

[b] Utilization of any after-school program other than Project Play in the past year

[c] The higher value among parent and teacher reporters at baseline (if both parent and teacher baseline data were missing parent posttest data were imputed [n = 4]); disorder diagnostic criteria includes 2 or more domains impaired on the Impairment Rating Scale (IRS).

[d] ADHD = Attention Deficit Hyperactivity Disorder, ODD = Oppositional Defiant Disorder, CD = Conduct Disorder

[e] Negative = minimal symptoms across diagnoses; intermediate = diagnostic criteria not met, but symptoms and impairments present; positive = full DSM-IV criteria met; comorbid = Intermediate or positive diagnosis for ≥ 2 disorders

[f] Multiple positive diagnoses

[g] Data collected during the 3rd and 4th weeks of the intervention

[h] Data log10(x) or log10(x+1) transformed

Table VIII. Intent-to-Treat Analysis: Measurements Obtained During the Intervention					
	Total (N = 35)	**Attention Control (N = 16)**	**Treatment (N = 19)**	***t* or χ^2**	***P Value*** [a]
	No. (%) or M (SD)	**No. (%) or M (SD)**	**No. (%) or M (SD)**		
Participation Indicators	*n* = 35	*n* = 16	*n* = 19		
Attendance	0.60 (0.26)	0.67 (0.17)	0.54 (0.31)	1.58	.125
% Attending more than 60%	23 (65.7%)	13 (81.3%)	10 (52.6%)	3.16	.076
Withdrew from study	2 (5.7%)	0 (0.0%)	2 (10.5%)	1.79	.181
Heart Rate Monitors (HRM)			*n* = 16		
Daily avg. HR, bpm[b]	-	-	140.56 (17.17)	-	-
Daily avg. %MHR[c]	-	-	75.27 (5.42)	-	-
Daily avg. high HR achieved, bpm			193.07 (10.01)	-	-
Daily avg. high %MHR achieved	-	-	103.00 (4.7)	-	-
Daily avg. HR duration, minute	-	-	24.70 (9.20)	-	-
Physical Activity During After-School Intervention[d]	*n* = 13	*n* = 6	*n* = 7		
Minutes of sedentary activity/day	45.81 (16.88)	47.86 (15.40)	44.05 (19.08)	0.39	.703
Minutes of light PA/day	81.88 (13.47)	84.76 (17.21)	79.42 (10.03)	0.70	.500
Minutes of MVPA/day	18.64 (12.14)	14.78 (8.76)	21.94 (14.27)	-1.20[g]	.255
Minutes of MVPA in bouts/day	5.83 (8.26)	2.88 (2.62)	8.35 (10.69)	-1.00[g]	.339
Behavior Management Strategies	*n* = 35	*n* = 16	*n* = 19		
Good News Notes awarded per student	0.74 (0.82)	0.75 (0.58)	0.74 (0.99)	0.57[g]	.574
Stars of the Day awarded per student	1.20 (1.28)	1.56 (1.41)	0.89 (1.10)	1.57	.126
Tickets earned in token economy per student	231.86 (122.60)	258.31 (95.88)	209.58 (139.95)	1.22	.135
Pizza parties through GBG, No.[e]	4	2	2	-	-
Offense contracts per student	2.17 (1.96)	2.50 (1.83)	1.89 (2.08)	0.91	.371
Days suspended per student	2.80 (3.65)	2.69 (3.38)	2.90 (3.96)	0.26[g]	.183
Expulsions	3 (8.6%)	2 (12.5%)	1 (5.3%)	0.58	.446
Potential Confounders	*n* = 35	*n* = 16	*n* = 19		
Enrolled in other program simultaneously	5 (18.5%)	3 (21.4%)	2 (15.4%)	0.16	.686
Major adverse events, No.	1	0	1	-	-
Psychiatric hospitalization	2 (5.7%)	1 (6.3%)	1 (5.3%)	0.02	.900
Police arrests, No.	4	1	3	-	-
Change in medication	0 (0.0%)	0 (0.0%)	0 (0.0%)	-	-
Parent correctly identified random group assignment[f]	7 (25.0%)	1 (7.1%)	6 (42.9%)	4.76	.029

[a] *p*-values reflect difference between Treatment and Control groups on independent samples *t*-test (continuous variables) or Chi-Square test (discrete variables)

[b] BPM = beats per minute

[c] %MHR = % Max Heart Rate, calculated as average HR divided by individual MHR as determined by the Progressive Aerobic Cardiovascular Endurance Run (PACER)

[d] Accelerometer output from 3:30-6:00pm between Monday and Friday during the third week of the program for students that wore the accelerometer for 3 days at least 10-hrs. per day

[e] GBG = Good Behavior Game

[f] Blind measured at posttest

[g] Data log10(x) or log10(x+1) transformed

a) Cognitive Outcomes (see Table IX. Intent-to-Treat Analysis - Cognitive Function Outcomes – Unadjusted Means & Standard Deviations, Effect Sizes, and Mixed Effects Model)

Initially, independent sample *t*-tests and chi-squared tests were run between outcome values at baseline to identify differences. In order to test *a priori* hypotheses of differences in change in outcomes over time linear mixed effects models were conducted interpreting the group x time interaction. Given limited sample size, this analysis was followed by paired sample *t*-tests of within group time effects and effect size analyses within and between groups over time.

Independent sample *t*-tests and chi-squared tests did not reveal any differences between groups on baseline values. The primary outcome measure in the current study, the BRIEF GEC, did not reach or trend towards significance between groups over time in the ITT linear mixed effects model (*t*-score $p \geq .10$, $d = 0.22$, percentile $p \geq .10$, $d = 0.22$). Similarly, among additional exploratory cognitive outcomes in the ITT linear mixed effects model no group x time *p*-values approached significance ($p = .294$ to .968, $d = -0.41$ to 0.53).

Among objective neurocognitive tasks, both groups evidenced significant within group improvement on paired *t*-tests in the STOP-IT SSRT (treatment $p \leq .01$, $d = .29$; attention control $p \leq .01$, $d = 1.27$), while only the treatment group obtained significant improvement in AWMA Verbal Working Memory Processing (standard score $p \leq .05$, $d = 0.62$; percentile $p \leq .05$, $d = 0.54$). Significant time-effects were also achieved for both groups on the parent-report cognitive measure, the BRIEF. The treatment condition obtained significant within-group improvements on the BRIEF Plan/Organize Subscale (t-score $p \leq .05$, $d = 0.81$; percentile $p \leq .05$, $d = 0.79$). Trends were evident on the Shift (t-score $p \leq .10$, $d = 0.93$; percentile $p \leq .10$, $d = 0.89$), Initiate (t-score $p \leq .10$, $d = 0.86$; percentile $p \leq .10$, $d = 0.85$), and Working Memory (t-score $p \leq .10$, $d = 0.93$; percentile $p \leq .10$, $d = 0.85$) subscales, and the BRI (t-score $p \leq .10$, $d = 0.70$; percentile $p \leq .10$, $d = 0.66$), MI (t-score $p \leq .10$, $d = 0.95$; percentile

Table IX. Intent-to-Treat Analysis - Cognitive Function Outcomes – Unadjusted Means & Standard Deviations, Effect Sizes, and Mixed Effects Model

	Attention Control Group (N = 16)		Treatment Group (N = 19)		Effect Size (*d*)[a]	Adjusted Mean Difference, Group x Time (95% CI)[b]	*P* Value, Group x Time[b]
	Baseline	Posttest	Baseline	Posttest			
	No. (%) or M (SD)	No. (%) or M (SD)	No. (%) or M (SD)	No. (%) or M (SD)			
STOP-IT[c]	*n* = 9	*n* = 14	*n* = 10	*n* = 13			
p(respond|signal)	48.49 (5.26)	48.89 (3.37)	47.75 (4.60)	48.42 (10.98)	-	-	-
SSD	344.44 (154.32)	425.95 (167.51)**	336.85 (110.50)	397.13 (167.09)***	0.16	39.80 (-56.48 to 136.08)	.431
SSRT	365.34 (105.98)	319.40 (118.11)***	394.90 (66.30)	361.68 (161.09)***	-0.17	-0.02 (-0.13 to -0.08)[g]	.654
Automated Working Memory Assessment System – Short Version (AWMA-S)	*n* = 16	*n* = 16	*n* = 18	*n* = 18			
Verbal Short Term Memory – Digit Recall							
Standard Score	96.84 (14.20)	94.56 (18.18)	93.73 (12.54)	95.01 (14.16)	0.24	3.58 (-2.99 to 10.15)	.294
Percentile	45.59 (28.59)	44.01 (33.89)	38.24 (25.66)	40.53 (30.14)	0.13	3.84 (-9.19 to 16.87)	.567
Verbal Working Memory – Listening Recall							
Standard Score	92.29 (16.04)	92.20 (14.06)	89.74 (14.31)	93.19 (7.87)	0.27	3.64 (-6.65 to 13.93)	.493
Percentile	36.43 (29.04)	34.88 (26.45)	31.72 (25.66)	34.67 (16.44)	0.18	4.68 (-15.04 to 24.41)	.645
Verbal Working Memory – Listening Recall Processing							
Standard Score	86.37 (10.06)	90.09 (13.78)	84.68 (9.33)	90.61 (9.74)**	0.21	2.45 (-5.56 to 10.45)	.554
Percentile	22.18 (19.01)	30.45 (26.63)	19.08 (16.21)	29.01 (20.83)**	0.08	-0.96 (-16.78 to 14.86)[g]	.906
Visuo-Spatial Short-Term Memory – Dot Matrix							
Standard Score	93.88 (12.27)	100.77 (12.47)*	89.82 (15.13)	92.76 (10.64)	-0.31	-4.25 (-14.74 to 6.24)	.434
Percentile	37.11 (26.03)	51.00 (25.96)	31.23 (26.94)	34.63 (22.89)	-0.41	-11.20 (-31.78 to 9.38)	.295
Visuo-Spatial Working Memory – Spatial Recall							
Standard Score	90.76 (12.78)	95.75 (14.76)	92.77 (16.01)	95.77 (17.10)	-0.13	-3.09 (-14.38 to 8.20)	.595
Percentile	31.23 (23.02)	43.68 (28.04)*	36.42 (28.86)	42.88 (33.73)	-0.21	-7.56 (-29.83 to 14.71)	.511
Visuo-Spatial Working Memory – Spatial Recall Processing							
Standard Score	90.56 (11.37)	93.10 (10.93)	90.27 (11.60)	94.48 (16.03)	0.13	1.11 (-8.70 to 10.91)	.826
Percentile	28.71 (22.87)	35.84 (21.85)	29.62 (22.87)	38.81 (31.35)	0.08	1.19 (-19.02 to 21.40)	.909
Behavioral Rating Inventory of Executive Function (BRIEF) – Parent Version	*n* = 12	*n* = 14	*n* = 14	*n* = 14			
Inhibit Scale							
T-Score	62.33 (7.77)	57.43 (10.07)**	62.93 (16.66)	55.36 (13.80)	0.22	-1.48 (-12.33 to 9.37)	.792
Percentile Rank	85.58 (9.33)	74.21 (23.56)**	73.43 (34.27)	64.21 (31.79)	-0.09	3.72 (-20.73 to 28.17)	.769
Shift Scale							
T-Score	63.00 (11.41)	55.50 (9.50)**	60.21 (14.39)	48.00 (11.79)*	0.40	-3.39 (-14.10 to 7.32)	.542
Percentile Rank	81.92 (23.27)	69.71 (22.40)*	74.07 (27.73)	47.93 (30.84)*	0.54	-11.64 (-36.17 to 12.90)	.364
Emotional Control Scale							
T-Score	61.67 (9.75)	54.36 (11.06)*	60.21 (13.40)	51.36 (13.00)	0.13	-0.22 (-10.60 to 10.16)	.968
Percentile Rank	82.08 (16.62)	64.43 (29.52)**	73.57 (23.44)	54.43 (32.77)	0.06	-0.58 (-27.25 to 26.09)	.967
Initiate Scale							
T-Score	61.50 (11.94)	54.36 (10.36)	61.64 (11.88)	52.14 (10.11)	0.21	-2.49 (-14.59 to 9.60)	.691
Percentile Rank	79.33 (23.30)	65.71 (26.27)	80.50 (22.93)	59.64 (26.38)*	0.29	-7.09 (-33.18 to 19.00)	.600
Working Memory Scale							
T-Score	64.67 (8.53)	56.93 (12.09)**	65.36 (11.24)	55.14 (10.78)*	0.23	-1.75 (-12.11 to 8.61)	.744
Percentile Rank	87.83 (14.21)	69.29 (28.88)**	85.43 (17.16)	67.50 (24.94)*	-0.03	1.42 (-20.56 to 23.41)	.900
Plan/Organize Scale							
T-Score	64.91 (10.69)	56.50 (11.62)*	65.14 (11.31)	55.64 (12.28)**	0.09	-1.12 (-12.39 to 10.14)	.847
Percentile Rank	85.00 (18.21)	68.71 (27.50)*	85.50 (13.72)	67.79 (31.31)**	0.06	154.96 (-2653.85 to 2963.76)[h]	.915
Organization of Materials Scale							
T-Score	56.83 (10.84)	53.86 (11.48)	59.07 (8.66)	54.07 (12.07)	0.19	-1.49 (-11.99 to 9.02)	.784
Percentile Rank	72.25 (25.73)	64.21 (33.11)	77.57 (21.59)	64.36 (31.59)	0.18	-626.88 (-3875.80 to 2622.03)[h]	.709
Monitor Scale							
T-Score	59.67 (9.12)	53.71 (13.16)**	59.00 (10.94)	51.71 (10.64)	0.12	-0.65 (-11.43 to 10.13)	.907
Percentile Rank	79.00 (22.62)	62.29 (32.90)**	75.21 (25.77)	61.86 (30.36)	-0.12	3.61 (-26.08 to 33.31)	.814
Behavioral Regulation Index (BRI)[d]							
T-Score	64.33 (9.48)	56.64 (10.85)**	62.79 (15.90)	52.29 (14.14)*	0.22	-1.40 (-12.73 to 9.93)	.812
Percentile Rank	85.50 (14.59)	69.64 (28.80)*	74.86 (27.24)	54.64 (34.08)*	0.17	-3.46 (-31.16 to 24.25)	.809

Table IX. Intent-to-Treat Analysis - Cognitive Function Outcomes – Unadjusted Means & Standard Deviations, Effect Sizes, and Mixed Effects Model (continued)

	Attention Control Group (N = 16)		Treatment Group (N = 19)		Effect Size (*d*)[a]	Adjusted Mean Difference, Group x Time (95% CI)[b]	*P* Value, Group x Time[b]
	Baseline	Posttest	Baseline	Posttest			
	No. (%) or M (SD)	No. (%) or M (SD)	No. (%) or M (SD)	No. (%) or M (SD)			
Metacognition Index (MI)[e]							
T-Score	63.83 (10.86)	55.71 (12.46)*	64.36 (9.71)	54.43 (11.20)*	0.16	-1.62 (-13.09 to 9.84)	.784
Percentile Rank	82.75 (24.18)	64.71 (32.45)*	83.86 (15.98)	63.71 (29.02)*	0.08	-1.71 (-28.61 to 25.19)	.902
Global Executive Composite (GEC)[f]							
T-Score	65.00 (10.25)	56.79 (11.83)**	64.71 (11.93)	54.00 (12.17)*	0.22	-2.04 (-13.63 to 9.56)	.734
Percentile Rank	84.00 (19.29)	67.79 (31.15)*	82.50 (16.91)	60.79 (31.40)*	0.22	-412.50 (-3384.22 to 2559.23)[h]	.788

Note: *=p ≤ .10, **=p ≤ .05, ***=p ≤ .01 within group change over time (paired t-test); there were no significant differences between groups in baseline values

a. Cohen's *d* = Treatment Change Score – Control Change Score / Pooled Standard deviation (positive value assigned to finding in expected direction)

b. Adjusted Mean Differences and *P*-Value, Group x Time reflect differences between Treatment and Control groups on change scores in the Linear Mixed Effects Model

c. *p* (respond|signal) = probability of responding on stop-signal trials, SSD = Stop-Signal Delay, SSRT = Stop Signal Reaction Time

d. BRI = Sum of Inhibit, Shift, and Emotional Control Scales

e. MI = Sum of Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor Scales

f. GEC = Sum of BRI and MI Indices

g. Data log-transformed

h. Data square-transformed

$p \leq .10$, $d = 0.90$), and GEC scales (t-score $p \leq .10$, $d = 0.89$; percentile $p \leq .10$, $d = 0.90$).

The attention control condition obtained significant within-group improvements on the Emotional Control (t-score $p \leq .10$, $d = 0.70$; percentile $p \leq .05$, $d = 0.77$), Working Memory (t-score $p \leq .05$, $d = 0.75$; percentile $p \leq .05$, $d = 0.86$), and Monitor (t-score $p \leq .05$, $d = 0.53$; percentile $p \leq .05$, $d = 0.60$) subscales, and the BRI (t-score $p \leq .05$, $d = 0.76$; percentile $p \leq .10$, $d = 0.73$), and GEC (t-score $p \leq .05$, $d = 0.74$; percentile $p \leq .10$, $d = 0.64$) scales. Trends were also evident in the control group for the BRIEF Plan/Organize Subscale (t-score $p \leq .10$, $d = 0.75$; percentile $p \leq .10$, $d = 0.71$) and MI scale (t-score $p \leq .10$, $d = 0.70$; percentile $p \leq .10$, $d = 0.64$).

Between group effect sizes were small on the STOP-IT task ($d = -0.17$). Small between group effects on the AWMA diverged with verbal tasks favoring the treatment group ($d = .08$ to $.27$) vs. visuo-spatial outcomes favoring controls ($d = .08$ to $-.41$). Among BRIEF scale and subscale outcomes 16 out of 18 favored the treatment group with small-moderate effects ($d = -.09$ to $.54$).

b) Behavior Outcomes (see Table X. Intent-to-Treat Analysis - Behavioral Outcomes – Unadjusted Means & Standard Deviations, Effect Sizes, and Linear Mixed Effects Models)

The analytical approach to behavioral outcomes was equivalent to that of cognitive outcomes. Initially, independent *t*-tests and chi-squared tests were run on baseline values to identify differences. Linear mixed effects models were then run for group x time interactions, followed by within and between group effect size calculations and paired *t*-test for time effects within groups. No significant differences were identified between groups at baseline. A group x time interaction favoring treatment was observed in the ITT mixed effects model for the Internalizing Subscale of the SSiS only ($p \leq .05$, $d = 1.27$). This effect remained significant even after controlling for baseline differences between groups on DISC ODD Diagnosis, not meeting criteria for any disorder on the DISC, parents correctly

Table X. Intent-to-Treat Analysis - Behavioral Outcomes – Unadjusted Means & Standard Deviations, Effect Sizes, and Linear Mixed Effects Models

	Attention Control (N = 16)		Treatment Group (N = 19)		Effect Size (*d*)[a]	Adjusted Mean Difference, Group x Time (95% CI)[b]	*P* Value, Group x Time[b]
	Baseline	Posttest	Baseline	Posttest			
	No. (%) or M (SD)	No. (%) or M (SD)	No. (%) or M (SD)	No. (%) or M (SD)			
Parent Disruptive Behavior Disorder (DBD) Rating Scale[c]	*n* = 13	*n* = 13	*n* = 13	*n* = 14			
ADHD Inattentive							
Symptoms endorsed	4.69 (2.81)	2.29 (2.37)**	4.85 (2.27)	2.86 (2.28)**	-0.17	0.32 (-1.95 to 2.59)	.787
Symptom severity	1.60 (0.67)	0.94 (0.61)***	1.50 (0.69)	1.02 (0.57)**	-0.29	0.15 (-0.48 to 0.78)	.646
ADHD Hyperactive							
Symptoms endorsed	3.62 (2.93)	2.14 (1.96)**	4.69 (2.78)	3.00 (2.29)*	0.09	-0.24 (-2.33 to 1.85)	.827
Symptom severity	1.32 (0.73)	0.85 (0.49)**	1.67 (0.74)	1.01 (0.61)**	0.30	-0.23 (-0.78 to 0.31)	.416
ADHD Combined							
Symptoms endorsed	8.31 (4.91)	4.43 (3.57)**	9.54 (4.05)	5.86 (4.11)**	0.01	0.06 (-3.69 to 3.80)	.977
Symptom severity	1.46 (0.58)	0.89 (0.43)**	1.59 (0.61)	1.02 (0.55)***	0.05	-0.04 (-0.60 to 0.48)	.888
ODD							
Symptoms endorsed	3.08 (2.25)	0.86 (1.83)***	3.69 (2.02)	1.57 (1.95)***	-0.05	0.08 (-0.14 to 0.30)[h, j]	.488
Symptom severity	1.28 (0.56)	0.69 (0.53)***	1.39 (0.54)	0.72 (0.66)***	0.12	-0.08 (-0.31 to 0.16)	.527
CD							
Symptoms endorsed	0.77 (0.93)	0.29 (1.07)**	1.46 (2.73)	1.07 (1.94)	-0.06	0.12 (-0.05 to 0.30)[h, j]	.181
Symptom severity	0.19 (0.14)	0.15 (0.22)**	0.31 (0.36)	0.24 (0.31)	0.09	0.01 (-0.05 to 0.06)[h, j]	.812
Parent Impairment Rating Scale (IRS) [c]	*n* = 12	*n* = 14	*n* = 13	*n* = 14			
Domains endorsed	3.83 (1.47)	1.79 (2.42)**	3.92 (1.26)	1.54 (2.07)**	0.21	-0.05 (-0.31 to 0.21)[h]	.712
Overall functional impairment	3.33 (1.92)	1.43 (2.03)**	3.23 (2.17)	1.50 (1.99)**	-0.15	0.04 (-0.28 to 0.36)[h]	.795
Best Friend							
Yes	12.00 (100.0%)	10 (71.4%)	8 (57.1%)	12 (85.7%)	-	-	-
No	0 (0.0%)	4 (28.6%)	6 (42.9%)	2 (10.5%)			
Parent Social Skills Improvement System (SSiS) [d]	*n* = 13	*n* = 13	*n* = 14	*n* = 14			
Communication Subscale							
Below Average	4 (30.8%)	2 (15.4%)	3 (21.4%)	-	0.13	0.05 (-0.37 to 0.46)	.833
Average	9 (69.2%)	10 (76.9%)	11 (78.6%)	13 (92.9%)*			
Above Average	-	1 (7.7%)	-	1 (7.1%)*			
Cooperation Subscale							
Below Average	7 (53.8%)	5 (38.5%)	5 (35.7%)	3 (21.4%)	-0.03	-0.04 (-0.55 to 0.48)	.894
Average	6 (46.2%)	7 (53.8%)	9 (64.3%)	10 (71.4%)			
Above Average	-	1 (7.7%)	-	1 (7.1%)			
Assertion Subscale							
Below Average	1 (7.7%)	5 (38.5%)	2 (14.3%)	1 (7.1%)	0.90	0.35 (-0.08 to 0.77)	.122
Average	12 (92.3%)	7 (53.8%)	12 (85.7%)	12 (85.7%)			
Above Average	-	1 (7.7%)	-	1 (7.1%)			
Responsibility Subscale							
Below Average	7 (53.8%)	5 (38.5%)	8 (57.1%)	4 (28.6%)*	0.50	0.26 (-0.23 to 0.75)	.316
Average	6 (46.2%)	8 (61.5%)	6 (42.9%)	8 (57.1%)*			
Above Average	-	-	-	2 (14.3%)*			
Empathy Subscale							
Below Average	3 (23.1%)	4 (30.8%)	2 (14.3%)	4 (28.6%)	-0.51	-0.29 (-0.87 to 0.29)	.337
Average	10 (76.9%)	8 (61.5%)	9 (64.3%)	9 (64.3%)			
Above Average	-	1 (7.7%)	3 (21.4%)	1 (7.1%)			
Engagement Subscale							
Below Average	1 (7.7%)	1 (7.7%)	1 (7.1%)	1 97.1%)	-0.01	-0.01 (-0.38 to 0.37)	.970
Average	12 (92.3%)	11 (84.6%)	12 (85.7%)	11 (78.6%)			
Above Average	-	1 (7.7%)	1 (7.1%)	2 (14.3%)			
Self-Control Subscale							
Below Average	6 (46.2%)	4 (30.8%)	4 (28.6%)	3 (21.4%)	-0.30	-0.16 (-0.77 to 0.45)	.609
Average	7 (53.8%)	7 (53.8%)	10 (71.4%)	10 (71.4%)			
Above Average	-	2 (15.4%)	-	1 (7.1%)			

Table X. Intent-to-Treat Analysis - Behavioral Outcomes – Unadjusted Means & Standard Deviations, Effect Sizes, and Linear Mixed Effects Models (continued)

	Attention Control (N = 16)		Treatment Group (N = 19)		Effect Size (*d*)[a]	Adjusted Mean Difference, Group x Time (95% CI)[b]	*P* Value, Group x Time[b]
	Baseline	Posttest	Baseline	Posttest			
	No. (%) or M (SD)	No. (%) or M (SD)	No. (%) or M (SD)	No. (%) or M (SD)			
Externalizing Subscale							
Below Average	-	1 (7.7%)*	-	2 (14.3%)**	0.08	-0.03 (-0.48 to 0.43)	.916
Average	7 (53.8%)	11 (84.6%)*	8 (57.1%)	11 (78.6%)**			
Above Average	6 (46.2%)	1 (7.7%)*	6 (42.9%)	1 (7.1%)**			
Bullying Subscale							
Below Average	-	-	-	-	-0.25	0.04 (-0.02 to 0.09)[h, j]	.232
Average	8 (61.5%)	12 (92.3%)**	10 (71.4%)	13 (92.9%)			
Above Average	5 (38.5%)	1 (7.7%)**	4 (28.6%)	1 (7.1%)			
Hyperactivity/Inattention Subscale							
Below Average	-	1 (7.7%)*	-	1 (7.1%)	-0.37	0.18 (-0.34 to 0.71)	.503
Average	6 (46.2%)	11 (84.6%)*	7 (50.0%)	10 (71.4%)			
Above Average	7 (53.8%)	1 (7.7%)*	7 (50.0%)	3 (21.4%)			
Internalizing Subscale							
Below Average	1 (7.7%)	-	1 (7.1%)	2 (14.3%)*	1.27	-0.66 (-1.20 to -0.11)	.028
Average	10 (76.9%)	10 (76.9%)	6 (42.9%)	11 (78.6%)*			
Above Average	2 (15.4%)	3 (23.1%)	7 (50.0%)	1 (7.1%)*			
Autism Spectrum Subscale							
Below Average	-	1 (7.7%)**	-	-	-0.92	0.39 (-0.11 to 0.89)	.145
Average	4 (30.8%)	11 (84.6%)**	8 (57.1%)	12 (85.7%)			
Above Average	9 (69.2%)	1 (7.7%)**	6 (42.9%)	2 (14.3%)			
Social Skills Scale[e]							
Standard Score	85.54 (13.64)	93.71 (14.11)	90.50 (12.06)	96.00 (13.81)	-0.20	-3.26 (-14.60 to 8.08)	.579
Percentile	22.85 (20.12)	32.92 (29.34)	30.43 (21.50)	41.14 (29.72)	0.03	-0.82 (-22.59 to 20.94)	.942
Problem Behaviors Scale[f]							
Standard Score	120.00 (13.95)	104.00 (11.69)**	119.79 (23.07)	102.21 (18.24)**	0.09	0.002 (-0.05 to 0.06)[h, j]	.945
Percentile	83.31 (16.32)	59.62 (25.94)**	74.86 (23.60)	50.21 (23.60)**	0.04	-0.10 (-22.95 to 22.75)	.993
Behavioral Observation of Students in Schools (BOSS)							
	n = 11	*n* = 14	*n* = 6	*n* = 16			
% Time Engaged Total	62.01 (23.30)	70.19 (17.22)	66.38 (14.22)	66.78 (26.61)	-0.38	0.02 (-0.21 to 0.25)[i]	.883
% Time Off-Task Motor	29.40 (28.95)	43.20 (15.11)*	36.84 (17.20)	46.73 (24.01)	0.18	-0.06 (-0.28 to 0.17)	.625
% Time Off-Task Verbal	24.16 (16.79)[#]	23.21 (18.32)	13.76 (0.07)[#]	23.63 (16.51)	-0.74	0.23 (-0.17 to 0.64)[h]	.274
% Time Off-Task Passive	06.67 (04.52)[#]	03.42 (04.24)**	08.62 (05.51)[#]	03.39 (05.92)**	0.39	-0.01 (-0.03 to 0.01)[h, j]	.772
School Attendance and Disciplinary Records[g]							
	n = 16	*n* = 16	*n* = 19	*n* = 19			
Days tardy	0.73 (1.28)	0.53 (1.06)	1.22 (2.13)	0.83 (1.89)	0.12	-0.01 (-0.23 to 0.21)[h, j]	.902
Days absent	2.47 (2.53)	2.87 (3.25)	2.78 (4.82)	3.06 (2.73)	0.04	-0.12 (-2.83 to 2.59)	.930
Disciplinary referrals	1.25 (3.47)	0.50 (1.10)	1.63 (2.39)	1.68 (2.89)	-0.33	0.03 (-0.13 to 0.20)[h, j]	.686
Suspensions	0 (0.00)	0 (0.00)	0 (0.00)	0.11 (0.46)	-0.92	-	-
Days suspended	0 (0.00)	0 (0.00)	0 (0.00)	0.32 (1.38)	-0.92	-	-

Note: *=p ≤ .10, **=p ≤ .05, ***=p ≤ .01 within group change over time (paired t-test); [#]=p ≤ .10, [##]=p ≤ .05, [###]=p ≤ .01 between group differences at baseline (independent samples t-test)

a. *d* = Cohen's *d* = Treatment Change Score – Control Change Score / Pooled standard deviation (positive value assigned to finding in expected direction)

b. Adjusted Mean Differences and *P*-Value, Group x Time reflect differences between Treatment and Control groups on change scores in the Linear Mixed Effects Model

c. ADHD = Attention treated as continuous variables in *t*-test, effect size, and mixed effects model calculations

d. Social Skills scale = sum of Communication, Cooperation, Assertion, Responsibility, empathy, Engagement, and Self-Control Subscales

e. Problem Behaviors Scale = sum of Externalizing, Bullying, Hyperactivity/Inattention, and Internalizing Subscales

f. Baseline = Academic Quarter 1, Posttest = Academic Quarter 3; all values per student

g. Data log10(x) or log10(x+1) transformed

h. Data square transformed

i. Data non-normal, interpret with caution

j. Deficit Hyperactivity Disorder, ODD = Oppositional Defiant Disorder, CD = Conduct Disorder

k. SSiS Subscales were

identifying their child's group (the blind), child having a best friend, and child seeing a mental health professional (all *p*s ≤ .05). No other values reached or trended towards significance (all *p*s ≥ .10, *d* = -0.92 to 0.90).

Paired sample *t*-tests revealed within group time effects for parent-reported symptom count and severity and impairment in both groups (all *p*s ≤ .05, *d* = 0.60 to 1.12) with the exception of ADHD Hyperactive symptoms ($p \leq .10$, $d = 0.67$) and CD symptoms ($p \geq .10$, $d = 0.17$) and severity ($p \geq .10$, $d = 0.19$) each of which did not reach significance in the treatment group. The SSiS Communication ($p \leq .10$, $d = 0.82$) and Responsibility ($p \leq .10$, $d = 0.73$) subscales revealed trends in the treatment group, while the Externalizing Subscale ($p \leq .05$, $d = 1.01$) and Problem Behaviors Scale (standard score $p \leq .05$, $d = 0.85$; percentile rank $p \leq .05$, $d = 1.04$) reached significance.

In the control group, the Externalizing ($p \leq .10$, $d = 1.00$) and Hyperactivity ($p \leq .10$, $d = 1.16$) subscales evidenced trends for improvement, while the Bullying ($p \leq .05$, $d = 0.79$), Autism Spectrum ($p \leq .05$, $d = 1.56$) subscales, and the Problem Behavior Scale (standard score $p \leq .05$, $d = 1.25$; percentile rank $p \leq .05$, $d = 1.12$) evidenced significant within group time effects. On the BOSS, only the Off-Task Passive (OFTP) percent time changed significantly over time in both the treatment ($p \leq .05$, $d = 0.92$) and control group ($p \leq .05$, $d = 0.74$), however, these data were non-normal despite transformation. No significant improvement was evident in school disciplinary and attendance records in either group (all *p*s ≥ .10, *d* = 0.19 to 0.46).

Between group effect sizes for parent symptom and impairment rating scales were small and inconsistent (*d* = -0.29 to 0.21), while SSiS scales demonstrated moderate-large effects in both directions. Namely, the SSiS Assertion (*d* = .90), Responsibility (*d* = .50), and Internalizing (*d* = 1.27) subscales favored the treatment condition, while the SSiS Empathy (*d* = -.51) and Autism Spectrum (*d* = -.92) subscales favored controls.

c) Academic Outcomes (see Table XI. Intent-to-Treat Analysis - Academic Outcomes– Unadjusted Means & Standard Deviations, Effect Sizes, and Linear Mixed Effects Model)

There were no differences in baseline values on academic outcomes and no *p*-values reached or trended towards significance in the linear mixed effects model (all *p*s ≥ .10, d = -0.51 to 0.27).

Paired sample *t*-tests revealed significant within group time effects for Reading Fluency ($p \leq .01$, $d = 0.14$, non-normal data) in the adaptive direction, and Physical Education ($p \leq .05$, $d = -1.87$) in the maladaptive direction in the Treatment group, as well as, a trend for more adaptive Reading Comprehension ($p \leq .05$, $d = 0.47$). The control group evidenced an adaptive trend for CBM-Math ($p \leq .10$, $d = 0.40$).

Effect sizes between groups were small and in both directions ($d = -0.20$ to 0.33) with the exception of World Language ($d = -.51$) and Physical Education ($d = -1.87$) GPA change, both of which favored the attention control group.

2. Per Protocol Analyses

The anticipated modest rates of non-attendance in the ITT analysis subsample made a per protocol analysis, in this case an analysis only including students that attended ≥ 3-days/week, of interest. The attendance rates in the per protocol subsamples ($n = 23$) were substantially higher (74% for controls and 81% for treatment) than in the intent-to-treat analyses ($n = 35$) (67% for controls and 54% for treatment) (see Table XII. Per Protocol: Participant Characteristics). Independent sample *t*-tests and chi-squared tests of baseline characteristics and participation indicators (see Table XIII. Per Protocol: Measurements Obtained During the Intervention) revealed significant differences between groups on attendance ($t = -.22$, $p \leq .05$), having a best friend ($\chi^2 = 4.17$, $p \leq .05$), ODD diagnosis ($\chi^2 = 6.40$, $p \leq .041$), sedentary minute/day on weekend as measured by accelerometer ($t = 4.33$, $p \leq .05$), and parent

Table XI. Intent-to-Treat Analysis - Academic Outcomes– Unadjusted Means & Standard Deviations, Effect Sizes, and Linear Mixed Effects Model

	Attention Control (N = 16)		Treatment Group (N = 19)		Effect Size (*d*)[a]	Adjusted Mean Difference, Group x Time (95% CI)[b]	*P* Value, Group x Time[b]
	Baseline	Posttest	Baseline	Posttest			
	No. (%) or M(SD)	No. (%) or M(SD)	No. (%) or M(SD)	No. (%) or M(SD)			
Curriculum-Based Measures (CBM)[c]	*n* = 15	*n* = 16	*n* = 15	*n* = 18			
Reading fluency (wrc / minute)	64.55 (49.56)[#]	74.85 (68.20)	47.49 (36.90)[#]	52.41 (35.41)***	-0.11	0.06 (-0.06 to 0.18)[e,g]	.350
Maze - reading comprehension (correct answers)	11.56 (8.08)	12.22 (4.87)	5.18 (3.60)	7.33 (5.48)*	0.27	1.57 (-2.22 to 5.36)	.429
Maze - reading comprehension (errors)	7.11 (9.80)	6.67 (7.566)	4.82 (4.49)	6.92 (8.74)	-0.33	0.05 (-0.32 to 0.41)[e]	.795
Math (correct digits)	14.4 (10.11)	19.36 (14.79)*	13.27 (9.18)	15.73 (9.98)	-0.23	-0.001 (-0.20 to 0.20)[e]	.994
Academic Records[d]	*n* = 15	*n* = 15	*n* = 18	*n* = 18			
GPA							
Reading	1.67 (1.05)	1.93 (0.96)	1.50 (1.04)	1.83 (1.10)	0.06	0.07 (-0.50 to 0.63)	.818
Writing	1.73 (1.17)	2.07 (1.16)	1.67 (1.03)	1.61 (1.04)	-0.35	-0.39 (-1.07 to 0.29)	.269
Listening	2.33 (1.05)	2.20 (0.78)	2.00 (0.84)	2.06 (0.10)	0.21	0.19 (-0.37 to -0.75)	.513
Speaking	2.64 (0.75)	2.93 (0.73)	2.38 (0.72)	2.61 (0.78)	-0.07	-0.05 (-0.60 to 0.50)	.855
Research	2.86 (1.22)	2.88 (0.99)	2.00 (0.47)	1.83 (1.03)	-0.19	-0.21 (-1.33 to 0.90)	.715
Mathematics	2.07 (0.88)	1.87 (0.83)	1.72 (0.96)	1.72 (1.02)	0.22	0.20 (-0.41 to 0.81)	.524
Science	2.27 (0.96)	2.13 (0.83)	2.11 (1.02)	1.89 (1.13)	-0.09	0.13 (-2.55 to 2.82)[f]	.923
Social Science	2.47 (1.13)	2.33 (1.11)	2.28 (1.13)	2.06 (1.26)	-0.08	-0.09 (-0.82 to 0.64)	.812
Art	3.53 (0.99)	3.4 (1.06)	3.11 (1.02)	3.22 (1.40)	0.22	2.36 (-1.20 to 5.91)[f,g]	.204
Music	3.73 (0.80)	3.53 (0.99)	3.44 (0.98)	3.33 (1.33)	0.09	1.13 (-3.18 to 5.44)[f,g]	.610
World Language	2.40 (1.99)	2.67 (1.18)	2.47 (1.41)	2.06 (1.44)	-0.51	-0.59 (-1.46 to 0.28)	.192
Physical Education	4.00 (0.00)	3.80 (0.56)	4.00 (0.00)	2.83 (1.51)**	-1.87	-[f,g]	-
Overall	2.64 (0.62)	2.63 (0.58)	2.43 (0.66)	2.29 (0.99)	-0.19	-0.07 (-1.51 to 1.38)[f]	.931

Note: *=p ≤ .10, **=p ≤ .05, ***=p ≤ .01 within group change over time (paired t-test); [#]=p ≤ .10, [##]=p ≤ .05, [###]=p ≤ .01 between group differences at baseline (independent samples t-test)

a. Cohen's *d* = Treatment Change Score – Control Change Score / Pooled Standard deviation
b. Adjusted Mean Differences and *p*-values reflect differences between Treatment and Control groups on change scores in the Linear Mixed Effects Model
c. WRC = words read correctly; Reading comprehension = Maze
d. Baseline = Academic Quarter 1, Posttest = Academic Quarter 3
e. Data log10(X) or log10(X+1) transformed
f. Data square transformed
g. Data non-normal despite transformation, interpret with caution

Table XII. Per Protocol Analysis - Participant Characteristics[a]					
Characteristics	**Total (N = 23)**	**Attention Control (N = 13)**	**Treatment (N = 10)**	***t* or χ^2**	***P* Value[a]**
	No. (%) or M (SD)	**No. (%) or M (SD)**	**No. (%) or (SD)**		
Demographics	*n* = 23	*n* = 13	*n* = 10		
Child Age (yrs)	8.22 (1.70)	8.38 (1.81)	8.00 (1.63)	0.53	.603
Male Gender	17 (73.9%)	9 (69.2%)	8 (80.0%)	0.34	.560
African-American	23 (100.0%)	13 (100.0%)	10 (100.0%)	-	-
Latino Ethnicity	0 (0.0%)	0 (0.0%)	0 (0.0%)	-	-
Parent marital status					
Unmarried	19 (86.4%)	11 (84.6%)	8 (88.9%)	0.08	.774
Married	3 (13.6%)	2 (15.4%)	1 (11.1%)		
Number of children in home	2.68 (1.25)	2.69 (1.18)	2.67 (1.41)	0.05	.964
Annual household income					
$0 - $10,000	11 (55.0%)	7 (58.3%)	4 (50.0%)	6.95	.138
$10,001 - $20,000	3 (15.0%)	2 (16.7%)	1 (12.5%)		
$20,001 - $30,000	4 (20.0%)	1 (8.3%)	3 (37.5%)		
$30,001 - $40,000	2 (10.0%)	2 (16.7%)	0 (0.0%)		
Parent employed	10 (45.5%)	5 (38.5%)	5 (50.0%)	0.63	.429
Parent highest education					
Less than high school	7 (36.8%)	3 (27.3%)	4 (50.0%)	1.71	.425
High school graduate	8 (42.1%)	6 (54.5%)	2 (25.0%)		
Some college	4 (21.1%)	2 (18.2%)	2 (25.0%)		
College/university grad	0 (0.0%)	0 (0.0%)	0 (0.0%)		
Graduate/professional	0 (0.0%)	0 (0.0%)	0 (0.0%)		
Past Year After-School Program Use[b]	*n* = 20	*n* = 11	*n* = 9		
Not at all	7 (35.0%)	4 (36.4%)	3 (33.3%)	0.76	.859
Once or twice	0 (0.0%)	0 (0.0%)	0 (0.0%)		
About once/week	3 (15.0%)	2 (18.2%)	1 (11.1%)		
Two or three Days/Week	3 (15.0%)	1 (9.1%)	2 (22.2%)		
Four or more day/week	7 (35.0%)	4 (36.4%)	3 (33.3%)		
Mental Health Service Use	*n* = 23	*n* = 13	*n* = 10		
Seen a Mental Health Provider	5 (21.7%)	4 (30.8%)	1 (10.0%)	1.43	.231
Medication for mental health	4 (17.4%)	3 (23.1%)	1 (10.0%)	0.67	.412
Non-disruptive Comorbidities	3 (13.0%)	2 (15.4%)	1 (10.0%)	0.14	.704
Parent/Teacher Disruptive Behavior Disorders (DBD) Rating Scale[c, d]	*n* = 22	*n* = 12	*n* = 10		
ADHD Inattentive					
Symptoms endorsed	5.23 (2.29)	5.42 (2.78)	5.00 (1.63)	0.42	.681
Symptom severity	1.66 (0.65)	1.69 (0.69)	1.62 (0.64)	0.25	.803
Criteria met	11 (50.0%)	7 (58.3%)	4 (40.0%)	0.73	.392
ADHD Hyperactive					
Symptoms endorsed	4.18 (2.87)	3.92 (3.00)	4.5 (2.83)	-0.47	.647
Symptom severity	1.50 (0.78)	1.38 (0.69)	1.63 (0.88)	-0.76	.459
Criteria met	9 (40.9%)	4 (33.3%)	5 (50.0%)	0.63	.429
ADHD Combined					
Symptoms endorsed	9.41 (4.50)	9.33 (5.12)	9.5 (3.89)	-0.08	.934
Symptom severity	1.57 (0.64)	1.51 (0.60)	1.63 (0.70)	-0.41	.686
Criteria met	7 (31.8%)	4 (33.3%)	3 (30.0%)	0.03	.867
ODD					
Symptoms endorsed	3.00 (2.16)	3.25 (2.26)	2.7 (2.11)	0.59	.565
Symptom severity	1.19 (0.64)	1.30 (0.58)	1.06 (0.72)	0.87	.394
Criteria met	8 (36.4%)	5 (41.7%)	3 (30.0%)	0.32	.571
CD					
Symptoms endorsed	0.91 (0.97)	1 (0.95)	0.8 (1.03)	0.47	.642
Symptom Severity	0.23 (0.19)	0.24 (0.17)	0.21 (0.22)	0.46	.654
Criteria met	2 (9.1%)	1 (8.3%)	1 (10.0%)	0.02	.892
Comorbid	5 (22.7%)	3 (25.0%)	2 (20.0%)	0.08	.781

Table XII. Per Protocol Analysis - Participant Characteristics (continued)[a]					
Characteristics	**Total (N = 23)**	**Attention Control (N = 13)**	**Treatment (N = 10)**	***t* or χ^2**	***P* Value[a]**
	No. (%) or M (SD)	**No. (%) or M (SD)**	**No. (%) or (SD)**		
Parent/Teacher Impairment Rating Scale (IRS)[c]	*n* = 22	*n* = 12	*n* = 10		
Domains endorsed	3.23 (1.45)	3.42 (1.57)	3.00 (1.33)	0.66	.514
Overall functional impairment	3.27 (2.05)	3.42 (1.78)	3.1 (2.42)	0.35	.728
Best Friend					
Yes	19 (86.4%)	12 (100.0%)	7 (70.0%)	4.17	.041
No	3 (13.6%)	0 (0.0%)	3 (30.0%)		
Diagnostic Interview Schedule for Children, Version IV – Parent Interview (DISC-IV-P)[d, e]	*n* = 22	*n* = 12	*n* = 10		
ADHD					
Positive diagnoses	13 (59.1%)	7 (58.3%)	6 (60.0%)	.038	.981
Intermediate diagnoses	7 (31.8%)	4 (30.8%)	3 (30.0%)		
ODD					
Positive diagnoses	5 (22.7%)	3 (25.0%)	2 (20.0%)	6.40	.041
Intermediated diagnoses	5 (22.7%)	5 (41.7%)	0 (0.0%)		
CD					
Positive diagnoses	0 (0.0%)	0 (0.0%)	0 (0.0%)	0.04	.840
Intermediate diagnoses	4 (18.2%)	2 (15.4%)	2 (20.0%)		
Comorbid[f]	6 (27.3%)	2 (16.7%)	4 (40.0%)	1.50	.221
Accelerometer-Measured Physical Activity (PA) Outside of the Intervention[f]	*n* = 11	*n* = 6	*n* = 5		
All Days					
Sedentary minute /day	302.97 (62.91)	330.72 (71.35)	269.67 (31.46)	1.76	.112
Minute of light PA/day	312.86 (67.82)	285.32 (62.90)	345.92 (63.62)	-1.58	.148
Minute of MVPA/day	22.13 (9.89)	18.55 (8.62)	26.42 (10.45)	-1.37	2.03
Minute of MVPA in bouts/day	2.89 (4.08)	0.90 (2.68)	5.27 (4.43)	-2.02	.074
Weekdays					
Sedentary minute /day	302.40 (66.41)	328.73 (75.07)	270.80 (41.15)	1.54	.159
Minute of light PA/day	310.02 (65.05)	284.17 (64.56)	341.05 (56.23)	-1.54	.158
Minute of MVPA/day	22.69 (11.19)	20.73 (9.74)	25.05 (13.48)	-.618	.552
Minute of MVPA in bouts/day	3.24 (5.00)	1.63 (4.00)	5.17 (5.82)	0.70[g]	.533
Weekend days					
Sedentary minute /day	335.60 (120.33)	458.00 (70.71)	254 (38.58)	4.33	.023
Minute of light PA/day	454.00 (234.66)	330.5 (86.97)	536.33 (284.48)	-.949	.413
Minute of MVPA/day	2.62 (0.19)	11.25 (3.18)	72 (30.51)	-2.66	.076
Minute of MVPA in bouts/day	47.70 (39.69)	0.00 (0.00)	27 (29.21)	-1.24	.303
Progressive Aerobic Cardiovascular Endurance Run (PACER)	-	-	*n* = 10		
15-meter laps completed	-	-	10.7 (2.98)	-	-
Fitness level					
Level 1	-	-	4 (40.0%)	-	-
Level 2	-	-	6 (60.0%)		
Maximum Heart Rate, bpm	-	-	188.11 (10.80)	-	-
Body Mass Index (BMI)	*n* = 20	*n* = 13	*n* = 7		
Age/gender percentile	78.53 (24.41)	72.32 (27.34)	90.07 (12.34)	-2.00	.062
Classification					
Underweight	0 (0.0%)	0 (0.0%)	0 (0.0%)	1.32	.517
Normal weight	8 (40.0%)	6 (46.2%)	2 (28.6%)		
Overweight	4 (20.0%)	3 (23.1%)	1 (14.3%)		
Obese	8 (40.0%)	4 (30.8%)	4 (57.1%)		

[a.] P-values reflect difference between Treatment and Control groups on *t*-test (continuous variables) or χ^2 test (discrete variables)
[b.] Utilization of any after-school program other than Project Play in the past year
[c.] The higher value among parent and teacher reporters at baseline (if both parent and teacher baseline data were missing parent posttest data were imputed [n = 4]); disorder diagnostic criteria includes 2 or more domains impaired on the Impairment Rating Scale (IRS).
[d.] ADHD = Attention Deficit Hyperactivity Disorder, ODD = Oppositional Defiant Disorder, CD = Conduct Disorder
[e.] Negative = minimal symptoms across diagnoses; intermediate = diagnostic criteria not met, but symptoms and impairments present; positive = full DSM-IV criteria met; comorbid = Intermediate or positive diagnosis for ≥ 2 disorders
[f.] Multiple positive diagnoses
[g.] Data collected during the 3rd and 4th weeks of the intervention
[h.] Data log10(x) or log10(x+1) transformed

Table XIII. Per Protocol Analysis - Measurements Obtained During the Intervention					
	Total (N = 23)	**Attention Control (N = 13)**	**Treatment (N = 10)**	***t* or χ^2**	***P Value*** [a]
	No. (%) or M (SD)	**No. (%) or M (SD)**	**No. (%) or M (SD)**		
Participation Indicators	*n* = 23	*n* = 13	*n* = 10		
Attendance	0.77 (0.08)	0.74 (0.08)	0.81 (0.07)	-.22	.042
% Attending more than 60%	23 (100.00%)	13 (100.00%)	10 (100.00%)	-	-
Withdrew from study	0 (0.00%)	0 (0.00%)	0 (0.00%)	-	-
Heart Rate Monitors (HRM)			*n* = 10		
Daily avg. HR, bpm[b]	-	-	142.28 (9.04)	-	-
Daily avg. %MHR[c]	-	-	0.75 (0.06)	-	-
Daily avg. high HR achieved, bpm	-	-	193.59 (6.67)	-	-
Daily avg. high %MHR achieved	-	-	1.03 (0.05)	-	-
Daily avg. HR duration, minute	-	-	24.82 (3.65)	-	-
Physical Activity During After-School Intervention[d]	*n* = 11	*n* = 6	*n* = 5		
Minute of sedentary activity/day	43.77 (16.57)	47.86 (15.41)	38.86 (18.29)	0.89	.398
Minute of light PA/day	83.40 (12.86)	84.76 (17.21)	81.76 (6.08)	0.37	.721
Minute of MVPA/day	19.42 (12.83)	14.78 (8.76)	24.98 (15.64)	-1.50[g]	.167
Minute of MVPA in bouts/day	6.60 (8.76)	2.88 (2.62)	11.07 (11.76)	-1.64[g]	.136
Behavior Management Strategies	*n* = 23	*n* = 13	*n* = 10		
Good News Notes awarded per student	1.09 (0.79)	0.85 (0.56)	1.4 (0.97)	-1.62	.129
Stars of the Day awarded per student	1.48 (1.31)	1.77 (1.42)	1.10 (1.10)	1.23	.233
Tickets earned in token economy per student	303.57 (70.35)	291.85 (69.00)	318.80 (72.76)	-0.91	.375
Pizza parties through GBG, No.[e]	4	2	2	-	-
Offense contracts per student	2.26 (1.81)	2.39 (1.61)	2.10 (2.13)	0.37	.718
Days suspended per student	2.57 (3.42)	2.39 (2.76)	2.80 (4.29)	-.68[g]	.510
Expulsions	1 (4.3%)	1 (7.7%)	0 (0.00)%	0.80[g,h]	.370
Potential Confounders	*n* = 20	*n* = 11	*n* = 9		
Enrolled in other program simultaneously	2 (10.0%)	2 (18.2%)	0 (0.0%)	1.82	.178
Major adverse events, No.	1	0	1	6.48	.594
Psychiatric hospitalization, No.	1	1	0	0.80	.370
Police arrests, No.	0	0	0	-	-
Change in medication	0 (0.0%)	0 (0.0%)	0 (0.0%)	-	-
Parent correctly identified random group assignment[f]	5 (25.0%)	0 (0.0%)	5 (55.6%)	8.15	.004

[a.] *p*-values reflect difference between Treatment and Control groups on independent samples *t*-test (continuous variables) or Chi-Square test (discrete variables)

[b.] BPM = beats per minute

[c.] %MHR = % Max Heart Rate, calculated as average HR divided by individual MHR as determined by the Progressive Aerobic Cardiovascular Endurance Run (PACER)

[d.] Accelerometer output from 3:30-6:00pm between Monday and Friday during the third week of the program for students that wore the accelerometer for 3 days at least 10-hrs. per day

[e.] GBG = Good Behavior Game

[f.] Blind measured at posttest

[g.] Data log10(x) or log10(x+1) transformed

[h.] Data nonnormal despite transformation, interpret with caution

correctly identifying their child's group assignment ($t = 8.15$, $p \leq .05$). Each was run in models for covarying effects on significant outcomes.

The analytical strategy for Per Protocol analyses was the same as that for ITT, namely, independent sample *t*-test for baseline differences, followed by a linear mixed effects model for group x time interaction, paired sample *t*-tests for within group time effects, and Cohen's *d* for change over time within and between groups.

a) Cognitive Outcomes (see Table XIV. Per Protocol Analysis: Cognitive Function Outcomes – Unadjusted Means & Standard Deviations, Effect Sizes, and Mixed Effects Model)

There were no significant differences between groups on baseline values of cognitive outcomes. The study's primary outcome, the BRIEF GEC, was not significantly different between groups over time ($p \geq .05$, $d = 0.29$; percentile rank $p \geq .05$, $d = 0.47$) in the per protocol linear mixed effects model. However, one trend was identified in group x time effects in the exploratory cognitive outcomes, AWMA verbal short-term memory (standard score $p \leq .10$, $d = 0.46$; percentile $p \leq .10$, $d = 0.38$), however, this trend slipped out of the $p \leq .10$ range after controlling for parental knowledge of the blind (standard score Adjusted Mean Difference [AMD] = 5.38, Standard Error [SE] = 3.48, $p = .140$; percentile AMD = 9.65, SE = 7.03, $p = .187$), DISC ODD diagnosis (standard score AMD = 5.20, SE = 3.16, p = .116; percentile AMD = 9.35, SE = 6.37, $p = .158$), and weekend sedentary minutes (standard score 12.13, SE = 5.35, $p = .108$; percentile AMD = 27.13, SE = 11.84, $p = .106$). No other effects achieved or trended towards significance for any cognitive outcomes in the per protocol analysis ($ps \geq .10$, $d = -0.80$ to 0.47).

Within groups time effects were evident in the per protocol analysis across a majority of the neurocognitive tasks. STOP-IT SSRT improved over time in both groups (treatment $p \leq .05$, $d = 0.27$; control $p \leq .05$, $d = 0.21$), which was also the case in the ITT analysis. Among AWMA results, verbal

Table XIV. Per Protocol Analysis - Cognitive Function Outcomes – Unadjusted Means & Standard Deviations, Effect Sizes, and Mixed Effects Model

	Attention Control Group (N = 13)		Treatment Group (N = 10)		Effect Size (*d*)[a]	Adjusted Mean Difference, Group x Time (95% CI)[b]	*P* Value, Group x Time[b]
	Baseline	Posttest	Baseline	Posttest			
	No. (%) or M (SD)	No. (%) or M (SD)	No. (%) or M (SD)	No. (%) or M (SD)			
STOP-IT[c]	*n* = 6	*n* = 12	*n* = 8	*n* = 8			
p(respond|signal)	48.77 (3.37)	48.96 (3.48)	47.24 (2.85)	51.50 (13.29)	-	-	-
SSD (milisec.)	382.98 (164.03)	441.38 (173.96)*	391.00 (109.49)	414.78 (192.78)***	0.22	71.22 (-29.55 to 171.98)	.199
SSRT (milisec.)	352.3 (115.57)	327.26 (124.41)**	397.84 (68.93)	363.98 (181.92)**	0.07	-0.04 (-0.17 to 0.09)[g]	.548
Automated Working Memory Assessment System – Short Version (AWMA-S)	*n* = 13	*n* = 13	*n* = 10	*n* = 10			
Verbal Short Term Memory – Digit Recall							
Standard Score	97.85 (14.71)	93.22 (19.38)	95.77 (11.51)	97.86 (13.09)	0.46	6.73 (-0.14 to 13.60)	.069
Percentile	47.87 (29.69)	42.06 (35.50)	41.34 (26.03)	46.98 (28.52)	0.38	11.45 (-1.41 to 24.31)	.096
Verbal Working Memory – Listening Recall							
Standard Score	90.57 (15.36)	91.75 (15.62)	84.15 (13.86)	91.78 (10.05)	0.47	6.45 (-6.80 to 19.69)	.351
Percentile	33.00 (26.56)	34.88 (29.40)	21.67 (22.90)	32.64 (20.79)	0.37	9.09 (-16.02 to 34.21)	.486
Verbal Working Memory – Listening Recall Processing							
Standard Score	85.22 (9.08)	88.86 (15.07)	83.15 (10.51)	91.57 (11.63)*	0.41	4.77 (-5.50 to 15.04)	.373
Percentile	19.72 (15.80)	28.66 (29.32)*	17.45 (19.36)	31.51 (24.72)*	0.23	2.97 (-19.50 to 25.43)[g]	.798
Visuo-Spatial Short-Term Memory – Dot Matrix							
Standard Score	92.48 (11.66)	100.11 (13.27)	93.66 (18.06)	92.57 (9.15)	-0.67	-8.54 (-22.33 to 5.25)	.239
Percentile	34.69 (24.64)	49.21 (26.91)***	40.46 (31.87)	33.54 (20.50)	-0.83	-20.98 (-47.61 to 5.65)	.138
Visuo-Spatial Working Memory – Spatial Recall							
Standard Score	91.19 (14.08)	99.53 (13.09)	95.17 (16.85)	92.12 (13.83)	-0.79	-11.40 (-8.20 to -14.60)	.117
Percentile	32.95 (25.07)	51.13 (25.45)	38.67 (33.62)	34.14 (29.82)	-0.80	-22.71 (-50.61 to 5.18)	.125
Visuo-Spatial Working Memory – Spatial Recall Processing							
Standard Score	90.75 (12.43)	95.88 (9.61)	91.78 (12.41)	90.29 (11.16)	-0.58	-6.61 (-18.54 to 5.31)	.290
Percentile	29.38 (24.87)	41.19 (20.48)	31.88 (25.84)	29.18 (24.87)	-0.60	-14.52 (-40.15 to 11.12)	.280
Behavioral Rating Inventory of Executive Function (BRIEF) – Parent Version	*n* = 12	*n* = 11	*n* = 10	*n* = 9			
Inhibit Scale							
T-Score	62.36 (8.16)	55.09 (9.76)**	61.60 (16.34)	50.22 (10.72)	0.37	-3.60 (-16.37 to 9.16)	.588
Percentile Rank	85.46 (9.77)	69.64 (24.62)**	72.30 (34.84)	54.33 (30.85)	0.09	-1.21 (-31.09 to 28.67)	.938
Shift Scale							
T-Score	64.44 (10.74)	54.73 (9.69)**	59.60 (14.69)	46.44 (10.20)**	0.30	-3.00 (-16.00 to 10.00)	.657
Percentile Rank	85.36 (20.94)	67.91 (24.02)**	72.50 (30.76)	44.22 (33.07)*	0.40	-8.82 (-38.69 to 21.06)	.571
Emotional Control Scale							
T-Score	63.00 (9.00)	52.55 (10.53)**	58.80 (12.93)	46.78 (11.01)*	0.14	-0.92 (-12.38 to 10.55)	.878
Percentile Rank	85.36 (12.72)	60.64 (31.67)**	71.50 (24.49)	42.44 (34.59)*	0.17	-3.40 (-35.46 to 28.66)	.838
Initiate Scale							
T-Score	62.64 (11.82)	54.91 (11.11)	61.70 (11.81)	50.33 (11.01)*	0.32	-4.07 (-18.94 to 10.80)	.599
Percentile Rank	81.36 (23.29)	66.73 (28.36)	81.50 (23.06)	52.33 (28.61)**	0.56	-14.74 (-47.23 to 17.74)	.387
Working Memory Scale							
T-Score	64.82 (8.931)	56.36 (12.54)**	66.40 (7.56)	56.00 (12.21)*	0.19	-1.87 (-14.22 to 10.48)	.771
Percentile Rank	87.73 (14.89)	67.18 (30.57)**	90.40 (7.14)	68.44 (28.31)*	0.07	-1.30 (-28.72 to 26.12)	.927
Plan/Organize Scale							
T-Score	65.45 (11.04)	56.00 (12.70)*	65.10 (11.01)	52.44 (13.88)**	0.26	-3.39 (-16.76 to 9.99)	.626
Percentile Rank	85.09 (19.09)	66.00 (29.79)*	86.10 (14.08)	58.89 (36.06)**	0.33	-8.16 (-37.95 to 21.62)	.599
Organization of Materials Scale							
T-Score	57.18 (11.29)	51.91 (12.12)	60.70 (8.49)	53.56 (11.88)	0.17	-1.52 (-13.44 to 10.40)	.806
Percentile Rank	72.55 (26.96)	58.45 (35.20)	81.40 (20.07)	63.78 (31.45)	0.12	-2.70 (-35.10 to 29.69)	.872
Monitor Scale							
T-Score	59.91 (9.52)	52.82 (13.13)*	58.50 (9.37)	49.00 (12.36)*	0.22	-2.14(-14.74 to 10.46)	.744
Percentile Rank	78.91 (23.73)	61.55 (35.02)*	76.10 (23.82)	53.67 (35.32)	0.17	-4.83 (-41.29 to 31.63)	.798
Behavioral Regulation Index (BRI)[d]							
T-Score	65.36 (9.21)	54.63 (10.28)**	61.30 (15.35)	47.56 (11.65)*	0.26	-2.51 (-15.620 to 10.61)	.713
Percentile Rank	87.73 (12.99)	65.36 (30.96)**	73.20 (28.71)	42.56 (34.78)*	0.31	-8.00 (-41.97 to 25.96)	.651
Metacognition Index (MI)[e]							
T-Score	64.45 (11.17)	54.91 (13.42)*	64.80 (7.25)	52.78 (13.23)**	0.22	-2.43 (-16.37 to 11.51)	.737
Percentile Rank	82.91 (25.35)	61.45 (35.26)*	87.30 (9.10)	57.44 (33.80)**	0.33	-7.93 (-41.26 to 25.40)	.647

Table XIV. Per Protocol Analysis - Cognitive Function Outcomes – Unadjusted Means & Standard Deviations, Effect Sizes, and Mixed Effects Model (continued)

	Attention Control Group (N = 13)		Treatment Group (N = 10)		Effect Size (*d*)[a]	Adjusted Mean Difference, Group x Time (95% CI)[b]	*P* Value, Group x Time[b]
	Baseline	Posttest	Baseline	Posttest			
	No. (%) or M (SD)	No. (%) or M (SD)	No. (%) or M (SD)	No. (%) or M (SD)			
Global Executive Composite (GEC)[f]							
T-Score	65.82 (10.33)	55.45 (12.14)**	64.60 (9.93)	51.00 (13.01)**	0.29	-3.16 (-16.91 to 10.59)	.659
Percentile Rank	84.91 (19.96)	64.00 (33.66)*	84.40 (14.06)	51.44 (35.21)**	0.47	-11.43 (-44.21 to 21.35)	.504

Note: *=p ≤ .10, **=p ≤ .05, ***=p ≤ .01 within group change over time (paired t-test); there were no significant differences between groups at baseline (independent samples t-test)

a. Cohen's *d* = Treatment Change Score – Control Change Score / Pooled Standard deviation (positive value assigned to finding in expected direction)

b. Adjusted Mean Differences and *p*-values reflect differences between Treatment and Control groups on change scores in the Linear Mixed Effects Model

c. *p* (respond|signal) = probability of responding on stop-signal trials, SSD = Stop-Signal Delay, SSRT = Stop Signal Reaction Time

d. BRI = Sum of Inhibit, Shift, and Emotional Control Scales

e. MI = Sum of Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor Scales

f. GEC = Sum of BRI and MI Indices

g. Data log-transformed

working memory processing, trended towards significance in both the treatment (standard score $p \leq .10$, $d = 0.76$; percentile $p \leq .10$, $d = 0.64$) and control (percentile only $p \leq .10$, $d = 0.40$) group, and visuo-spatial short-term memory percentile improved significantly in the control group ($p \leq .01$, $d = 0.56$).

Nearly all BRIEF scales and subscales changed significantly over time in both groups in the per protocol analysis. In the treatment group, the Shift (t-score $p \leq .05$, $d = 1.06$; percentile rank $p \leq .10$, $d = 0.89$), Initiate (t-score $p \leq .10$, $d = 1.00$; percentile rank $p \leq .05$, $d = 1.13$), Plan/Organize (t-score $p \leq .05$, $d = 1.02$; percentile rank $p \leq .05$, $d = 1.09$), MI (t-score $p \leq .05$, $d = 1.17$; percentile rank $p \leq .05$, $d = 1.39$), and GEC (t-score $p \leq .10$, $d = 1.19$; percentile rank $p \leq .10$, $d = 1.34$) scales and subscales reached significance. While the Working Memory (t-score $p \leq .10$, $d = 1.05$; percentile rank $p \leq .10$, $d = 1.24$), Emotional Control (t-score $p \leq .10$, $d = 1.00$; percentile rank $p \leq .10$, $d = 0.98$), Monitor (t-score $p \leq .10$, $d = 0.87$; percentile rank $p \leq .10$, $d = 0.76$), and BRI (t-score $p \leq .05$, $d = 1.02$; percentile rank $p \leq .05$, $d = 0.97$) scales and subscales trended towards significance.

In the control group, the Inhibit (t-score $p \leq .05$, $d = 0.82$; percentile rank $p \leq .10$, $d = 0.92$), Shift (t-score $p \leq .05$, $d = 0.95$; percentile rank $p \leq .05$, $d = 0.78$), Emotional Control (t-score $p \leq .05$, $d = 1.07$; percentile rank $p \leq .05$, $d = 1.11$), Working Memory (t-score $p \leq .05$, $d = 0.79$; percentile rank $p \leq .05$, $d = 0.90$), BRI (t-score $p \leq .05$, $d = 1.10$; percentile rank $p \leq .05$, $d = 1.02$), and GEC reached significance (t-score $p \leq .05$, $d = 0.92$; percentile rank $p \leq .10$, $d = 0.78$), while the Plan/Organize (t-score $p \leq .10$, $d = 0.80$; percentile rank $p \leq .10$, $d = 0.78$), Monitor (t-score $p \leq .10$, $d = 0.63$; percentile rank $p \leq .10$, $d = 0.59$), and MI (t-score $p \leq .10$, $d = 0.78$; percentile rank $p \leq .10$, $d = 0.71$) scales and subscales trended towards significance.

Between group effect sizes present in the ITT analysis were enhanced in the per protocol analysis. AWMA results again split in direction by domain. With small effects in verbal processes favoring the treatment condition ($d = .23$ to $d = .46$) and moderate-large effects in the visuo-spatial

outcomes favoring controls (*d* =-.58 to -.83). BRIEF scales were universally in the direction of the treatment condition with moderate effect sizes for the Initiate scale (*d* = .56) and small effects for all other scales of roughly double the magnitude of that observed in the ITT analysis (*d* = .07 to .47). The GEC which is the composite of all BRIEF variables and the primary outcome in this study upon which a large effect size was anticipated and utilized in power analyses finished with a small effect size (t-score *d* = 0.29; percentile *d* = 0.47) in favor of the treatment condition.

b) Behavior Outcomes (see Table XV. Per Protocol Analysis - Behavioral Outcomes – Means & Standard Deviations, Effect Sizes, and Linear Mixed Effects Model)

Independent sample *t*-tests revealed no significant baseline differences between groups beyond a trend on the Empathy Subscale of the SSiS ($p \leq .10$). The linear mixed effects model yielded trends for two variables, the Internalizing Subscale of the SSiS ($p \leq .10$, $d = 1.27$) and the Autism Spectrum Subcale of the SSiS ($p \leq .10$, $d = -1.38$), the former in favor of the treatment and the latter controls. The internalizing trend in favor of controls disappeared after controlling for baseline group differences in having a best friend (AMD = -0.58, SE = 0.35, p = .112) while the autism spectrum advantage for control maintained its trend towards significant after controlling for all 5 baseline group differences in participant characteristics and participation indicators: attendance rate, having a best friend, ODD diagnosis, weekend sedentary minutes, and parent correctly identifying child group assignment (all *p*s ≤ .10). No other scales or subscales approached significance.

Parent symptom and impairment ratings scale outcomes again demonstrated significant within group time effects in paired *t*-tests in the control (all *p*s ≤ .05, *d* = 0.77 to 2.09) and treatment groups (all *p*s ≤ .05, *d* = 0.90 to 2.12), with the exception of ADHD hyperactive symptom count in the treatment group ($p \leq .10$, $d = 0.95$), which trended towards significance, and CD symptom count ($p \geq .10$, *d* = Among SSiS scales and subscales in the treatment group, the Communication Subscale ($p \leq .10$, *d* =

Table XV. Per Protocol Analysis - Behavioral Outcomes – Means & Standard Deviations, Effect Sizes, and Linear Mixed Effects Model							
	Attention Control (N = 13)		**Treatment Group (N = 10)**		**Effect Size (*d*) or OR[a]**	**Adjusted Mean Difference, Group x Time (95% CI)[b]**	***P* Value, Group x Time[b]**
	Baseline	**Posttest**	**Baseline**	**Posttest**			
	No. (%) or M (SD)	**No. (%) or M (SD)**	**No. (%) or M (SD)**	**No. (%) or M (SD)**			
Parent Disruptive Behavior Disorder (DBD) Rating Scale[c]	*n* = 12	*n* = 11	*n* = 8	*n* = 9			
ADHD Inattentive							
Symptoms endorsed	4.92 (2.81)	2.36 (2.42)**	4.88 (1.81)	2.56 (2.70)**	-0.10	0.04 (-2.62 to 2.71)[h]	.975
Symptom severity	1.63 (0.69)	0.96 (0.61)**	1.61 (0.69)	1.01 (0.64)**	-0.11	0.01 (-0.73 to 0.75)	.984
ADHD Hyperactive							
Symptoms endorsed	3.75 (3.02)	1.82 (1.99)**	4.88 (2.64)	2.67 (2.00)*	0.12	-0.63 (-3.07 to 1.81)	.621
Symptom severity	1.33 (0.76)	0.76 (0.49)**	1.76 (0.79)	1.01 (0.56)**	0.27	-0.33 (-0.97 to 0.32)	.340
ADHD Combined							
Symptoms endorsed	8.67 (4.94)	4.18 (3.60)**	9.75 (3.95)	5.22 (4.55)**	0.01	-0.42 (-5.12 to 4.27)[h]	.862
Symptom severity	1.48 (0.60)	0.86 (0.43)**	1.69 (0.68)	1.01 (0.59)**	0.09	-0.11 (-0.77 to 0.55)	.754
ODD							
Symptoms endorsed	3.25 (2.26)	0.36 (0.50)***	3.38 (1.77)	0.67 (1.00)***	-0.13	0.02 (-0.22 to 0.27)[h]	.854
Symptom severity	1.29 (0.59)	0.55 (0.23)***	1.30 (0.58)	0.49 (0.44)***	0.14	-0.14 (-0.41 to 0.12)[h]	.303
CD							
Symptoms endorsed	0.83 (0.94)	0.00 (0.00)***	1.00 (1.07)	0.44 (0.73)	-0.41	0.11 (-0.08 to 0.29)[h,j]	.275
Symptom severity	0.19 (0.14)	0.07 (0.08)***	0.25 (0.22)	0.16 (0.14)	-0.19	0.02 (-0.04 to 0.07)[h]	.555
Parent Impairment Rating Scale (IRS) [c]	*n* = 12	*n* = 11	*n* = 10	*n* = 9			
Domains endorsed	3.83 (1.47)	1.45 (2.38)**	3.38 (0.92)	1.00 (1.32)**	-0.00	-0.03 (-0.31 to 0.26)	.856
Overall functional impairment	3.33 (1.92)	1.45 (2.07)**	3.38 (2.45)	0.89 (1.36)***	0.31	-0.10 (-0.38 to 0.18)[h]	.497
Best Friend							
Yes	12 (100.0%)	9 (81.8%)	7 (70.0%)	7 (77.8%)	-	-	-
No	0 (0.0%)	2 (18.2%)	3 (30.0%)	2 (22.2%)			
Parent Social Skills Improvement System (SSiS) [d]	*n* = 12	*n* = 11	*n* = 10	*n* = 9			
Communication Subscale							
Below Average	4 (33.3%)	1 (9.1%)**	2 (20.0%)	-	-0.05	-0.03 (-0.47 to 0.40)	.878
Average	8 (66.7%)	9 (81.8%)**	8 (80.0%)	8 (88.9%)*			
Above Average	-	1 (9.1%)**	-	1 (11.1%)*			
Cooperation Subscale							
Below Average	7 (58.3%)	5 (45.5%)	3 (30.0%)	2 (22.2%)	-0.05	-0.04 (-0.627 to 0.55)	.901
Average	5 (41.7%)	5 (45.5%)	7 (70.0%)	6 (66.7%)			
Above Average	-	1 (9.1%)	-	1 (11.1%)			
Assertion Subscale							
Below Average	1 (8.3%)	4 (36.4%)	1 (10.0%)	-	1.01	0.40 (-0.07 to 0.88)	.115
Average	11 (91.7%)	6 (54.5%)	9 (90.0%)	8 (88.9%)			
Above Average	-	1 (9.1%)	-	1 (11.1%)			
Responsibility Subscale							
Below Average	7 (58.3%)	5 (45.5%)	6 (60.0%)	2 (22.2%)	0.67	0.31 (-0.20 to 0.83)	0.246
Average	5 (41.7%)	6 (54.5%)	4 (40.0%)	6 (66.7%)			
Above Average	-	-	-	1 (11.1%)			
Empathy Subscale							
Below Average	3 (25.0%)[#]	3 (27.3%)	1 (10.0%)[#]	2 (22.2%)	-0.66	-0.39 (-1.05 to 0.28)	0.273
Average	9 (75.0%)[#]	7 (63.6%)	6 (60.0%)[#]	6 (66.7%)			
Above Average	-[#]	1 (9.1%)	3 (30.0%)[#]	1 (11.1%)			
Engagement Subscale							
Below Average	1 (8.3%)	1 (9.1%)	1 (10.0%)	1 (11.1%)	0.31	0.13 (-0.32 to 0.57)	.585
Average	11 (91.7%)	9 (81.8%)	9 (90.0%)	6 (66.7%)			
Above Average	-	1 (9.1%)	-	2 (22.2%)			
Self-Control Subscale							
Below Average	5 (41.7%)	4 (36.4%)	3 (30.0%)	1 (11.1%)	0.29	0.16 (-0.51 to 0.83)	.651
Average	7 (58.3%)	6 (54.5%)	7 (70.0%)	7 (77.8%)			
Above Average	-	1 (9.1%)	-	1 (11.1%)			

Table XV. Per Protocol Analysis - Behavioral Outcomes – Means & Standard Deviations, Effect Sizes, and Linear Mixed Effects Model (continued)

	Attention Control (N = 13)		Treatment Group (N = 10)		Effect Size (*d*) or OR[a]	Adjusted Mean Difference, Group x Time (95% CI)[b]	*P* Value, Group x Time[b]
	Baseline	Posttest	Baseline	Posttest			
	No. (%) or M (SD)	No. (%) or M (SD)	No. (%) or M (SD)	No. (%) or M (SD)			
Externalizing Subscale							
Below Average	-	1 (9.1%)*	-	1 (11.1%)**	0.02	-0.01 (-0.54 to 0.53)	.982
Average	6 (50.0%)	9 (81.8%)*	6 (60.0%)	8 (88.9%)**			
Above Average	6 (50.0%)	1 (9.1%)*	4 (40.0%)	-			
Bullying Subscale							
Below Average	-	-	-	-	-0.41	0.05 (-0.02 to 0.13)[h,j]	.172
Average	7 (58.3%)	10 (90.9%)**	8 (80.0%)	9 (100.0%)			
Above Average	5 (41.7%)	1 (9.1%)**	2 (20.0%)	-			
Hyperactivity/Inattention Subscale							
Below Average	-	1 (9.1%)*	-	-	-0.63	0.29 (-0.35 to 0.93)	.382
Average	5 (41.7%)	9 (81.8%)*	5 (50.0%)	7 (77.8%)			
Above Average	7 (58.3%)	1 (9.1%)*	5 (50.0%)	2 (22.2%)			
Internalizing Subscale							
Below Average	-	-	1 (10.0%)	2 (22.2%)	0.87	-0.63 (-1.29 to 0.03)	.081
Average	10 (83.3%)	8 (72.7%)	5 (50.0%)	7 (77.8%)			
Above Average	2 (16.7%)	3 (27.3%)	4 (40.0%)	-			
Autism Spectrum Scale							
Below Average	-	1 (9.1%)***	-	-	-1.38	0.53 (0.00 to 1.07)	.067
Average	3 (25.0%)	10 (90.9%)***	6 (60.0%)	8 (88.9%)			
Above Average	9 (75.0%)	-	4 (40.0%)	1 (11.1%)			
Social Skills Scale[e]							
Standard Score	85.00 (14.10)	92.00 (14.64)	91.60 (9.14)	98.11 (15.83)	-0.04	-1.39 (-14.04 to 11.27)	.833
Percentile	22.42 (20.95)	31.18 (29.52)	30.20 (20.91)	46.22 (34.12)*	0.28	5.11 (-19.06 to 29.27)	.684
Problem Behaviors Scale[f]							
Standard Score	121.75 (12.99)	104.09 (12.23)***	117.90 (20.69)	98.11 (9.12)**	0.16	-1.94 (-18.76 to 14.88)	.824
Percentile	86.17 (13.21)	59.73 (26.97)**	75.70 (22.02)	47.11 (23.02)**	0.10	-0.97 (-26.03 to 24.10)	.941
Behavioral Observation of Students in Schools (BOSS)							
	n = 10	*n* = 13	*n* = 4	*n* = 9			
% Time Engaged Time	62.94 (24.33)	71.31 (17.38)	73.96 (0.05)	77.31 (0.18)	-0.31	-0.03 (-0.29 to 0.24)	.851
% Time Off-Task Motor	31.44 (29.68)	43.43 (15.70)*	31.43 (18.29)	41.05 (21.65)	0.11	-0.06 (-0.34 to 0.22)	.705
% Time Off-Task Verbal	22.69 (16.93)	23.18 (19.07)	10.28 (0.05)	24.61 (20.54)	-0.89	0.31 (-0.19 to 0.81)[h]	.253
% Time Off-Task Passive	6.28 (4.58)	3.31 (4.39)***	6.52 (5.13)	2.16 (3.08)	0.32	-0.01 (-0.03 to 0.02)[h]	.630
School Attendance and Disciplinary Records[g]							
	n = 13	*n* = 13	*n* = 10	*n* = 10			
Days tardy	0.62 (1.19)	0.54 (1.13)	0.30 (0.67)	0.90 (2.51)	-0.49	0.06 (-0.13 to 0.26)[h,j]	.547
Days absent	2.46 (2.73)	3.08 (3.40)	2.30 (5.91)	1.50 (1.78)	0.41	-1.42 (-4.77 to 1.94)[h]	.418
Disciplinary referrals	1.15 (3.87)	0.23 (0.60)	0.50 (0.71)	0.30 (0.67)	-0.49	-0.01 (-0.18 to 0.17)[h,j]	.943
Suspensions	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	-	-	-
Days suspended	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	-	-	-

Note: *=p ≤ .10, **=p ≤ .05, ***=p ≤ .01 within group change over time (paired t-test); #=p ≤ .10, ##=p ≤ .05, ###=p ≤ .01 between group differences at baseline (independent samples t-test)

a. *d* = Cohen's *d* = Treatment Change Score – Control Change Score / Pooled Standard deviation (positive value assigned to finding in expected direction)

b. Adjusted Mean Differences and *p*-values reflect differences between Treatment and Control groups on change scores in the Linear Mixed Effects Model

c. ADHD = Attention Deficit Hyperactivity Disorder, ODD = Oppositional Defiant Disorder, CD = Conduct Disorder

d. SSiS Subscales were treated as continuous variables in *t*-test, effect size, and mixed effects model calculations

e. Social Skills scale = sum of Communication, Cooperation, Assertion, Responsibility, empathy, Engagement, and Self-Control Subscales

f. Problem Behaviors Scale = sum of Externalizing, Bullying, Hyperactivity/Inattention, and Internalizing Subscales

g. Baseline = Academic Quarter 1, Posttest = Academic Quarter 3; all values per student

h. Data log10(x) or log10(x+1) transformed

i. Data square transformed

j. Data non-normal despite transformation, interpret with caution

0.82) and Social Skills Scale (standard score $p \leq .10$, $d = 0.52$; percentile $p \geq .10$, $d = 0.58$) each evidenced trends, while the Externalizing Subscale ($p \leq .05$, $d = 1.20$) and Problem Behavior Scale (standard score $p \leq .05$, $d = 1.33$; percentile $p \leq .05$, $d = 1.27$) again achieved significant within-group time effects. In the attention control group, the Externalizing ($p \leq .10$, $d = 1.03$) and Hyperactivity/Inattention ($p \leq .10$, $d = 1.21$) subscales trended towards significance, while the Communication ($p \leq .05$, $d = 0.71$), Bullying ($p \leq .05$, $d = 0.80$), and Autism Spectrum ($p \leq .05$, $d = 2.23$) subscales, and the Problem Behavior Scale achieved significance (standard score $p \leq .05$, $d = 1.40$; percentile $p \leq .05$, $d = 1.32$). Within group time effects were evident on the BOSS in controls only in the per protocol analysis, where off-task motor % time trended maladaptively ($p \leq .10$, $d = 0.53$) and off-task passive % time was decreased by half ($p \leq .01$, $d = 0.67$).

Smaller between group effect sizes on behavioral outcomes in the ITT analysis inflated in the per protocol analysis. The Assertion Subscale rose to a large effect of $d = 1.01$, Responsibility to $d = .67$, and Internalizing Subscale to $d = .87$ all in favor of the treatment group. Conversely, the empathy ($d = -.66$), Hyperactivity / Inattentention ($d = -.63$), and Autism Spectrum ($d = -1.38$) scales inflated to moderate-large effects in favor of the control group. There was a large effect on Off-Task Verbal in favor of controls ($d = -.89$) due to an increase in off-task verbal in the treatment group.

c) Academic Outcomes (see Table XVI. Per Protocol Analysis - Academic Outcomes– Unadjusted Means & Standard Deviations, Effect Sizes, and Linear Mixed Effects Model)

Paired *t*-tests revealed no group differences on baseline academic outcomes. The linear mixed effects model yielded one group x time trend, Music GPA, in favor of the treatment group ($p \leq .10$, $d = 0.79$). This trend also disappeared after controlling for weekend sedentary activity (AMD = 2.50, SE = 5.28, $p = 0.67$) and DISC ODD Diagnosis (AMD = 3.15, SE = 1.86, $p = .105$)

Contrary to the cognitive and behavior domains, only one academic value significantly improved

Table XVI. Per Protocol Analysis - Academic Outcomes– Unadjusted Means & Standard Deviations, Effect Sizes, and Linear Mixed Effects Model

	Attention Control (N = 13)		Treatment Group (N = 10)		Effect Size (*d*)[a]	Adjusted Mean Difference, Group x Time (95% CI)[b]	*P* Value, Group x Time[b]
	Baseline	Posttest	Baseline	Posttest			
	No. (%) or M(SD)	No. (%) or M(SD)	No. (%) or M(SD)	No. (%) or M(SD)			
Curriculum-Based Measures (CBM)[c]	*n* = 9	*n* = 13	*n* = 9	*n* = 10			
Reading fluency (wrc/minute)	52.93 (45.76)	64.33 (68.53)	35.33 (28.46)	40.73 (28.59)**	-0.18	0.08 (-0.08 to 0.25)[e]	.346
Maze - reading comprehension (correct answers)	10.29 (8.79)	11.43 (5.32)	5.20 (3.42)	5.60 (4.16)	-0.21	-0.74 (-5.13 to 3.64)	.747
Maze - reading comprehension (errors)	8.43 (10.91)	7.86 (8.30)	3.40 (1.67)	3.60 (1.95)	0.27	0.05 (-0.42 to 0.51)[e]	.853
Math (correct digits)	14.92 (11.30)	20.11 (16.24)	12.29 (7.25)	15.71 (9.09)	-0.16	0.08 (-0.21 to 0.37)[e]	.571
Academic Records[d]	*n* = 13	*n* = 13	*n* = 10	*n* = 10			
GPA							
Reading	1.69 (1.11)	1.92 (1.04)	1.50 (1.08)	2.20 (1.03)*	0.44	0.47 (-0.26 to 1.20)	.221
Writing	1.77 (1.24)	2.08 (1.26)	1.6 (0.97)	1.90 (0.88)	-0.01	-0.01 (-0.90 to 0.89)	.987
Listening	2.32 (1.11)	2.31 (0.75)	2.20 (0.79)	2.50 (0.71)	0.36	0.30 (-0.36 to 0.93)	.358
Speaking	2.67 (0.79)	2.92 (0.76)	2.67 (0.87)	3.00 (0.67)	0.10	0.04 (-0.66 to 0.74)	.915
Research	2.80 (1.30)	3.00 (1.00)	2.33 (0.58)	2.40 (0.89)	-0.14	-0.17 (-1.86 to 1.53)	.857
Mathematics	2.08 (0.86)	1.92 (0.86)	1.90 (0.88)	2.20 (0.79)	0.54	0.45 (-0.26 to 1.17)	.227
Science	2.38 (0.96)	2.15 (0.90)	2.30 (1.06)	2.40 (0.52)	0.39	0.85 (-2.48 to 4.19)[f]	.621
Social Science	2.62 (1.12)	2.62 (0.87)	2.50 (1.08)	2.80 (0.79)	0.31	0.30 (-0.51 to 1.11)	.474
Art	3.77 (0.83)	3.69 (0.75)	3.60 (0.52)	3.90 (0.32)*	0.62	2.792 (-1.65 to 7.23)[f,g]	.232
Music	3.77 (0.83)	3.69 (0.75)	3.60 (0.84)	4.00 (0.00)	0.79	3.09 (-0.40 to 6.59)[f,g]	.097
World Language	2.54 (1.33)	2.69 (1.11)	3.22 (0.83)	2.90 (1.10)	-0.44	-0.43 (-1.45 to 0.59)	.417
Physical Education	4.00 (0.00)	3.92 (0.28)	4.00 (0.00)	3.70 (0.48)*	-1.17	-[f,g]	-
Overall	2.70 (0.64)	2.73 (0.55)	2.64 (0.55)	2.85 (0.46)	0.31	0.17 (-0.14 to 0.48)	.293

Note: *=p ≤ .10, **=p ≤ .05, ***=p ≤ .01 within group change over time (paired t-test); There were no significant differences between groups at baseline (independent samples t-test)

[a] Cohen's *d* = Treatment Change Score – Control Change Score / Pooled Standard deviation (positive value assigned to finding in expected direction)

[b] Adjusted Mean Differences and *p*-values reflect differences between Treatment and Control groups on change scores in the Linear Mixed Effects Model

[c] WRC = words read correctly; Reading comprehension = Maze

[d] Baseline = Academic Quarter 1, Posttest = Academic Quarter 3

[e] Data log10(X) or log10(X+1) transformed

[f] Data square transformed

[g] Data non-normal despite transformation, interpret with caution

in the treatment condition over time, CBM Reading Fluency ($p \leq .05$, $d = 0.19$). Three GPA measures approached significance for within group time effects in the treatment condition, two in the adaptive direction, Reading ($p \leq .10$, $d = 0.66$) and Art ($p \leq .10$, $d = 0.72$) and one in the maladaptive direction, Physical Education ($p \leq .10$, $d = -1.24$). No within group time-effects were observed in the control condition for academic outcomes.

Moderate between group effect sizes were evident for GPA in Mathematics ($d = .54$), Art ($d = .62$), and Music ($d = .79$), all in favor of the treatment condition; while a large group effect favored the control group in Physical Education GPA ($d = -1.17$).

3. Correlations between Participant Characteristics, Participation Indicators, and Change Scores

In the interest of better understanding the role that the program may have played in within group time effects and to take a preliminary glimpse at potential participant characteristics that may moderate program impact, exploratory bivariate correlations were conducted between participation indicators (i.e., treatment group average daily percent of maximum heart rate [%MHR], attendance, combined and within each group), participant characteristics (i.e., DISC diagnoses, symptom severity, overall impairment, age, gender, and BMI age/gender percentile) and change scores across domains (i.e., cognitive, behavioral, academic outcomes).

Change scores were operationalized as posttest value – baseline value for selected outcomes. All dependent variables not presented in tables were not significantly correlated to the selected participation indicators or participant characteristics. Positive values have been assigned to correlations in the adaptive direction (improvement), and negative correlations to those in the maladaptive direction (worsening). Finally, only change scores reaching normality initially or after transformation were included in bivariate correlations and therefore change scores for AWMA Visuospatial Working Memory Standard Score, DBD Rating Scale CD Severity, DBD Rating Scale ODD Symptoms

Endorsed, DBD Rating Scale CD Symptoms Endorsed, SSiS Bullying Subscale, SSiS Problem Behavior Standard Score, SSiS Social Skills Percentile, BOSS Off-Task Passive, CBM Reading Fluency, and Disciplinary Referrals were excluded.

a) Participation Indicators (see Table XVII. Intent-to-Treat Analysis: Bivariate Correlations between Participant Characteristics and Selected Outcomes)

In regards to attendance, treatment group attendance was largely unrelated to change scores, with only BRIEF change scores correlated with the attendance in an adaptive direction throughout. In all, greater treatment group attendance rate was significantly related to reductions in ODD symptoms (severity $r = .65$, $p \leq .05$; count $r = .65$, $p \leq .05$) and improved GPA ($r = .56$, $p \leq .05$), while improvements on the BRIEF Initiate Scale ($r = .52$, $p \leq .10$) trended towards significance.

Control attendance was more strongly related to cognitive change scores with significance reached for changes in AWMA Visuospatial Working Memory (standard score $r = .72$, $p \leq .05$; percentile $r = .65$, $p \leq .05$) and Visuospatial Working Memory Processing (standard score $r = .54$, $p \leq .05$; percentile $r = .47$, $p \leq .05$). Among BRIEF change scores, 4 scales reached or trended towards significance and all were in the adaptive directions: Inhibit Scale (t-score $r = .57$, $p \leq .10$, percentile $r = .60$, $p \leq .10$), Shift Scale (t-score $r = .77$, $p \leq .05$; percentile $r = .76$, $p \leq .05$), Emotional Control (t-score $r = .62$, $p \leq .10$, percentile $r = .69$, $p \leq .05$), and BRI (t-score $r = .69$, $p \leq .05$; percentile $r = .71$, $p \geq .10$). Among SSiS subscales, the Autism Spectrum Subscale ($r = .63$, $p \leq .05$) and Communication Subscale ($r = .66$, $p \leq .05$) change scores were significantly and adaptively related to control attendance, while the correlation with Social Skills Standard Score change score trended towards significance ($r = .54$, $p \leq .10$).

Combined attendance evidenced similar themes but more change scores reached significant correlations due to the larger sample size. Adaptive correlations were demonstrated across change scores

Table XVII. Intent-to-Treat Analysis: Bivariate Correlations between Participation Indicators and Change Scores for Selected Outcomes[a]

	Treatment Group Average % Max HR[b] (N = 19)		Treatment Group Attendance Rate (N = 19)		Control Group Attendance Rate (N = 16)		Combined Attendance Rate (N = 35)	
	n	***r***	***n***	***r***	***n***	***r***	***n***	***r***
Change Scores for Cognitive Outcomes								
STOP-IT task								
Stop-Signal Reaction Time	6	-.78*	9	-.30	8	-.22	17	.26
Automated Working Memory Assessment System (AWMA)								
Verbal Working Memory Processing Standard Score	10	.31	17	-.15	16	-.49*	33	-.27
Verbal Working Memory Processing Percentile	10	.44*	17	-.07	16	-.46	35	-.21
Visuospatial Working Memory Standard Score	10	.81**	17	-.25	16	.72**	33	.01
Visuospatial Working Memory Percentile	10	.78**	17	-.26	16	.65**	33	-.02
Visuospatial Working Memory Processing Standard Score	10	.79**	17	-.26	16	.54**	33	-.03
Visuospatial Working Memory Processing Percentile	10	.79**	17	-.28	16	.47*	33	-.06
Behavioral Rating Inventory of Executive Function (BRIEF)								
Inhibit Scale – T-Score	9	-.41	12	.34	10	.57*	22	.38*
Inhibit Scale – Percentile	9	-.21	12	.18	10	.60*	22	.25
Shift Scale – T-Score	9	.06	12	.34	10	.77**	22	.42*
Shift Scale – Percentile	9	.23	12	.25	10	.76**	22	.35
Emotional Control Scale – T-Score	9	-.07	12	.46	10	.62*	22	.47**
Emotional Control Scale– Percentile	9	.02	12	.29	10	.69**	22	.36**
Initiate Scale – T-Score	9	.21	12	.49	10	.40	22	.40*
Initiate Scale – Percentile	9	-.36	12	.52*	10	.36	22	.42**
Plan/Organize Scale – T-Score	9	-.44	12	.42	10	.46	22	.39*
Behavioral Regulation Index – Percentile	9	-.17	12	.28	10	.71	22	.36*
Behavioral Regulation Index – T-Score	9	-.21	12	.41	10	.69**	22	.45**
Global Executive Composite - Percentile	9	-.32	12	.41	10	.55	22	.40*
Global Executive Composite – T-Score	9	-.32	12	.39	10	.52	22	.40*
Change Scores for Behavioral Outcomes								
Parent Disruptive Behavior Disorder (DBD) Rating Scale								
ADHD Inattention Severity	7	-.71*	10	-.29	12	.02	22	.16
ADHD Hyperactivity Severity	7	-.63	10	.53	12	.18	22	.36**
ADHD Combined Severity	7	-.74*	10	.48	12	.07	22	.28
ODD Severity	7	-.21	10	.65**	12	.17	22	.41*
Parent Impairment Rating Scale (IRS)								
Domains Endorsed	7	.77*	10	.32	11	.29	21	.27
Social Skills Improvement System (SSiS)								
Communication Subscale	9	.34	12	.24	11	.66**	23	.11
Autism Spectrum	9	.29	12	.16	11	.63**	23	.29
Social Skills Standard Score	9	.03	12	.14	11	.54*	23	.25
Behavioral Observation of Students in Schools (BOSS)								
Off-Task Verbal	4	.95**	6	-.53	10	.42	16	-.02
Change Scores for Academic Outcomes								
Curriculum-Based Measure (CBM)								
Maze – Words Correct	9	-.82**	14	-.55	12	.15	26	-.28
Maze – Errors[d]	9	-.79*	14	.19	12	-.03	26	.09
Academic Records								
Overall GPA[c]	10	.08	18	.56**	15	.21	33	.50***

Note: * = $p \leq .10$, ** = $p \leq .05$, *** $p \leq .01$; *r* and *p*-values reflect bivariate correlations between participation indicators and change scores (posttest value – baseline value) in selected outcomes (all outcomes not presented were not significantly correlated to participation indicators); positive values have been assigned to correlations in the adaptive direction, and negative correlations to those in the maladaptive direction.

[a] Acronyms: BRIEF = Behavioral Rating Inventory of Executive Function – Parent Version, SSiS = Social Skills Improvement System – Parent Version, IRS = Impairment Rating System – Parent Version, DBD Rating Scale = Disruptive Behavior Disorders (DBD) Rating Scale – Parent Version, ADHD = Attention Deficit Hyperactivity Disorder, ODD = Oppositional Defiant Disorder, CD = Conduct Disorder, AWMA = Automated Working Memory Assessment System, BOSS = Behavioral Observation of Students in Schools

[b] Average % Max HR = Daily average percent of maximum heart rate (HR) achieved during intervention

[c] Quarter 3 – Quarter 1

[d] Data log10(x) or log10(x+1) transformed

for 4 BRIEF scales (r = .40 to .47, all ps ≤ .05), Parent DBD Rating Scale Hyperactivity Severity (r = .36, $p \leq .05$), overall impairment (r = .52, $p \leq .05$), and overall GPA (r = .50, $p \leq .05$). Trends towards significance were evident for 4 additional BRIEF scales (r = .36 to .40, $p \leq .10$) and parent-reported ODD severity (r = .41, $p \leq .10$).

Of considerable interest given the study's conceptual model were the relationships between the average %MHR achieved during physically active play in the treatment group and change scores. Average %MHR within the treatment group demonstrated stronger more consistent adaptive correlations to neurocognitive tasks (STOP-IT and AWMA) than attendance combined or in either group. Change scores on neurocognitive tasks were all positively associated with Avg. %MHR with two outcomes reaching significance, Visuospatial Working Memory (standard score r = .81, $p \leq .05$; percentile r = .78, $p \leq .05$), and Visuospatial Working Memory Processing (standard score r = .79, $p \leq .05$; percentile r = .79, $p \leq .05$); while 2 others, STOP-ITT SSRT (r = .78, $p \leq .10$) and Verbal Working Memory Processing (standard score r = .31, $p \geq .10$; percentile r = .44, $p \leq .10$) trended towards significance.

Parent symptom rating scale change scores demonstrated maladaptive trends related to average %MHR on two outcomes, ADHD inattention severity (r = -.71, $p \leq .10$) and ADHD combined severity (r = -.74, $p \leq .10$). In contrast, an adaptive trend was demonstrated for change in parent-reported domains impaired (r =.77, $p \leq .10$). Average %MHR was significantly related to adaptive change in an objective behavioral outcome, BOSS percent time off-task verbal (r = .95, $p \leq .05$). Academic outcomes were largely unrelated to Avg. %MHR, with the exception of reading comprehension, where both MAZE outcome change scores were related to %MHR maladaptively, correct answers (r = -.82, $p \leq .05$) and errors (r = -.79, $p \leq .05$).

b) Participant Characteristics and Change Scores in the Control Group (see Table XVIII. Intent-to-Treat Analysis: Bivariate Correlations between Participant Characteristics and Change Scores on Selected Outcomes in the Control Group)

Among correlations between DISC diagnoses and changes scores, ADHD diagnosis was most widely related to change scores, adaptively on the SSiS Initiate Subscale (t-score $r = .66$, $p \leq .05$; percentile $r = .68$, $p \leq .05$), SSiS Monitor Subscale (t-score $r = .59$, $p \leq .10$; percentile $r = .66$, $p \leq .05$), and CBM reading fluency ($r = .67$, $p \leq .10$). ADHD diagnosis in the control group was also related to reduced performance in the SSRT inhibition task over time ($r = -.85$, $p \leq .05$). DISC ODD Diagnosis was only related to a trend for MAZE reading comprehension ($r = .62$, $p \leq .10$). DISC CD Diagnosis was adaptively related to SSiS Assertion Subscale improvement ($r = .56$, $p \leq .10$) and maladaptively related to SSiS Self-Control Subscale change ($r = -.53$, $p \leq .10$).

In the control group, parent/teacher baseline DBD Rating Scale symptom severities for ADHD were related to change scores across domains but especially behavioral outcomes in the control group. Greater baseline ADHD inattention was adaptively related to improvements in parent-rated ADHD inattention over time (symptom severity $r = .53$, $p \leq .10$; symptom count $r = .51$, $p \leq .10$) and ADHD Combined (symptom severity $r = .52$, $p \leq .10$; symptom count $r = .51$, $p \leq .10$). Students with higher baseline inattention severity also evidenced a trend towards greater reductions in domains endorsed as impaired ($r = .56$, $p \leq .10$) and increases in parent-rated self-control on the SSiS ($r = .64$, $p \leq .05$).

Similarly, higher baseline ADHD hyperactivity severity was related to greater improvements across 4 BRIEF scales: Initiate (percentile $r = .64$, $p \leq .05$), Organization of Materials (t-score $r = .73$, $p \leq .05$; percentile $r = .76$, $p \leq .05$), Monitor (t-score $r = .67$, $p \leq .05$; percentile $r = .61$, $p \leq .10$), and Metacognition Index (t-score $r = .59$, $p \leq .10$; percentile $r = .59$, $p \leq .10$). As was the case with inattention symptom severity, baseline hyperactivity symptom severity was related to greater improvements in

Table XVIII. Intent-to-Treat Analysis: Bivariate Correlations between Baseline Participant Characteristics and Change Scores for Selected Outcomes in the Control Group[a,b]												
	DISC-IV Diagnosis[c]			Parent/Teacher DBD Rating Scale Baseline Symptom Severity[d]					Parent/ Teacher Baseline IRS[d]	Demographics		
	ADHD	ODD	CD	ADHD Inattentive	ADHD Hyperactive	ADHD Combined	ODD	CD	Overall Impairment	Age	Gender[e]	BMI %ile
Change Scores for Cognitive Outcomes												
STOP-IT task												
Stop-Signal Reaction Time	-.85**	.36	-.17	-.33	-.58	-.49	-.14	.34	-.46	-.13	.11	.53
Automated Working Memory Assessment System (AWMA)												
Verbal WM Processing SS	.12	.04	.38	-.51*	-.09	-.37	-.31	-.02	.03	-.03	-.09	.06
Verbal WM Processing %ile	.14	-.06	.35	-.51*	-.03	-.33	-.18	-.02	-.21	.13	-.23	-.07
Visuospatial WM %ile	.04	.00	-.18	-.08	-.17	-.16	-.40	-.32	-.26	-.66***	-.03	.27
Visuospatial WM Processing SS	.02	.17	-.18	.16	-.33	-.09	-.37	-.39	-.10	-.46*	-.03	.45*
Visuospatial WM Processing %ile	.06	.20	-.18	.11	-.33	-.12	-.36	-.32	-.04	-.41	-.01	.49*
Behavioral Rating Inventory of Executive Function (BRIEF)												
Inhibit – T-Score	-.05	-.44	-.10	.10	.03	.03	-.06	.11	-.50	.09	-.30	-.59*
Initiate – T-Score	.66**	-.17	.11	.17	.57	.46	.47	.39	-.23	-.31	-.05	-.04
Initiate - %ile	.68**	-.10	.11	.29	.64**	.58*	.51	.34	-.18	-.19	.01	.03
Org. of Materials – T-Score	.52	.07	.28	.23	.73**	.58*	.37	.10	-.12	.05	.27	.35
Org. of Materials – %ile	.49	.04	.27	.25	.76**	.60*	.42	.08	-.22	.13	.22	.32
Monitor – T-Score	.59*	.20	.27	.46	.67**	.69**	.50	.50	-.01	.01	.17	.05
Monitor - %ile	.66**	.07	.08	.54	.61*	.71**	.60	.53	.01	-.04	.11	-.02
MI – T-Score	.59	-.08	.17	.27	.59*	.52	.38	.31	-.17	-.08	.09	-.22
MI - %ile	.62	-.16	.06	.32	.59*	.56*	.46	.27	-.19	-.11	.02	-.24
Change Scores for Behavioral Outcomes												
Parent Disruptive Behavior Disorder (DBD) Rating Scale												
ADHD Inattentive Severity	.41	-.18	.04	.53*	.38	.51*	.21	-.02	-.25	.47	-.01	-.33
ADHD Hyperactivity Severity	.36	-.05	.11	.42	.70**	.68**	.49	.05	-.22	.18	.03	-.20
ADHD Combined Severity	.34	-.14	.07	.52*	.56*	.63**	.35	.01	-.26	.37	.01	-.12
ODD Severity	-.02	-.18	-.11	.11	.26	.26	.58**	.30	-.50*	-.08	-.28	.08
ADHD Inattentive Symptoms Endorsed	.33	-.23	-.01	.51*	.418	.54*	.24	-.13	-.26	.42	-.04	-.25
ADHD Hyperactivity Symptoms Endorsed	.32	-.07	.10	.38	.67**	.64**	.43	-.15	-.23	.35	-.00	.29
ADHD Combined Symptoms Endorsed	.35	-.18	.04	.49	.57*	.63**	.35	-.15	-.27	.44	-.03	-.02
Parent Impairment Rating Scale (IRS)												
Domains Endorsed[f]	.33	-.22	-.06	.56*	.26	.44	-.10	-.21	.06	.39	-.08	-.34

Table XVIII. Intent-to-Treat Analysis: Bivariate Correlations between Baseline Participant Characteristics and Change Scores for Selected Outcomes in the Control Group (continued)[a,b]

	DISC-IV Diagnosis[c]			Parent/Teacher DBD Rating Scale Baseline Symptom Severity[d]					Parent/ Teacher Baseline IRS[d]	Demographics		
	ADHD	ODD	CD	ADHD Inattentive	ADHD Hyperactive	ADHD Combined	ODD	CD	Overall Impairment	Age	Gender[e]	BMI %ile
Social Skills Improvement System (SSiS)												
Assertion	.52	.21	.56*	-.21	.41	.15	.38	.29	-.10	-.12	.09	.28
Engagement	-.52	-.43	-.15	-.66**	-.44	-.67**	-.27	-.23	-.44	-.22	-.42	-.18
Self-Control	.02	.00	-.53*	.64**	.26	.55*	.46	.11	.28	.12	.11	.36
Hyperactivity/Inattention	.17	.16	.27	.22	.67**	.53*	.34	.10	-.24	.15	.04	.31
Change Scores for Academic Outcomes												
Curriculum-Based Measure (CBM)												
Reading Comprehension – Correct	.67*	.62*	.29	.22	.37	.41	.40	-.07	.32	-.31	.02	.74**
Reading Comprehension – Errors	.10	.28	.57	.44	.62*	.63	.44	.07	.20	.10	.32	-.48
Academic Records												
Overall GPA[g]	-.13	-.29	-.28	.15	-.21	-.04	-.32	-.53**	-.19	.19	-.17	-.20

Note: * = $p \leq .10$, ** = $p \leq .05$, *** $p \leq .01$; *r* and *p*-values reflect bivariate correlations between participation indicators and change scores (posttest value – baseline value) in selected outcomes (all outcomes not presented were not significantly correlated to participation indicators); positive values have been assigned to correlations in the adaptive direction, and negative correlations to those in the maladaptive direction.

a. Acronyms: BRIEF = Behavioral Rating Inventory of Executive Function – Parent Version, SSiS = Social Skills Improvement System – Parent Version, IRS = Impairment Rating System – Parent Version, DBD Rating Scale = Disruptive Behavior Disorders (DBD) Rating Scale – Parent Version, ADHD = Attention Deficit Hyperactivity Disorder, ODD = Oppositional Defiant Disorder, CD = Conduct Disorder, AWMA = Automated Working Memory Assessment System, DISC = Diagnostic Interview Schedule for Children

b. Average % Max HR = Daily average percent of maximum heart rate (HR) achieved during intervention

c. 0 = Negative Diagnosis (DSM-IV criteria not met), 1 = Intermediate Diagnosis (diagnostic criteria not met, but symptoms and impairments present), 3 = Positive Diagnosis = DSM-IV criteria met

d. The higher value among parent and teacher reporters at baseline (if both parent and teacher baseline data were missing parent posttest data were imputed [n = 4])

e. 0 = female, 1 = male

f. Data log-tranformed

g. Quarter 3 – Quarter 1

itself. In other words, greater baseline hyperactivity severity was related to greater improvements in hyperactive (r =.70, $p \leq .05$) and combined (r =.56, $p \leq .10$) symptom severity and count (hyperactive r =.67, $p \leq .05$; combined r =.57, $p \leq .10$) over the course of the study on both the Parent DBD Rating Scale. This was supported by SSiS change scores on the Hyperactivity/Inattention Subscale which also demonstrated more improvement in participants with higher initial values (r =.67, $p \leq .05$). Students with higher hyperactivity severity at baseline also evidenced a trend towards greater reductions in reading comprehension errors in the control group (r =.62, $p \leq .10$).

In contrast to the ADHD severity variables in the control group, ODD and CD symptom severity and baseline overall impairment were largely unrelated to change scores in the control group (all ps $\geq$ .10) with the exception of baseline ODD severity being related to greater decreases in ODD symptoms severity (r = .58, $p \leq .05$), higher baseline CD severity being related to decrements in overall GPA (r = -.53, $p \leq .05$) and higher baseline overall impairment being related to worsening of ODD severity (r = -.50, $p \leq .10$) over the course of the control intervention.

Among demographics collected at baseline, gender was not related to change scores (r = -.42 to .41, all ps $\geq$ .10), while increased age was associated with less improvement in the AWMA Visuospatial Working Memory percentile (r = -.64, $p \leq .05$) and AWMA Visuospatial Working Memory Processing Standard Score (r = -.46, $p \leq .10$) in the control group. In contrast, higher BMI percentile trended towards greater improvements in AWMA Visuospatial Working Memory Processing (standard score r =.45, $p \leq .10$; (r =.49, $p \leq .10$) and MAZE reading comprehension (r = .74, $p \leq .05$), while simultaneously trending towards less improvement in parent-rated inhibition on the BRIEF (r =-.59, $p \leq$ .10).

c) Participant Characteristics and Change Scores in the Treatment Group (see Table XIX. Intent-to-Treat Analysis: Bivariate Correlations between Baseline Participant Characteristics and Change Scores for Selected Outcomes in the Treatment Group)

In the treatment group, many of the same themes held as for the control group. DISC Diagnoses for ADHD, ODD, and CD were related to decrements in Visuospatial working memory over the course of the treatment intervention with the finding being especially strong for ODD and CD diagnosis (r = -.60 to -.70, all ps $\leq .05$). DISC ADHD diagnosis demonstrated a large correlation with improvement in inattention symptoms (severity $r = .56$, $p \leq .10$; count $r = .55$, $p \leq .10$) but not any other outcomes. ODD diagnosis trended towards an association with greater improvements in SSiS cooperation ($r = .54$, $p \leq .10$) and empathy ($r = .50$, $p \leq .10$). CD diagnosis was related with decrements in impairment (overall r = -.59, $p \leq .10$; domains endorsed r = -.68, $p \leq .05$), and percentage of time in the BOSS observed off-task verbal (r = -.94, $p \leq .05$) but was related to greater improvements in parent-reported cooperation (r = .51, $p \leq .10$), and decreases in BOSS percent time observed in off-task motor behaviors (r = -.90, $p \leq .05$).

In the treatment group, baseline ADHD inattention severity was related to improvements in visuospatial short-term memory (standard score $r = .51$, $p \leq .05$; percentile $r = .50$, $p \leq .05$), improvements in inattention severity and symptoms endorsed ($r = .67$, $p \leq .01$ and $r = .61$, $p \leq .10$, respectively), greater improvements in empathy ($r = .62$, $p \leq .05$), and a trend towards decrements in externalizing behavior (r = -.52, $p \leq .10$). High baseline ADHD hyperactivity severity was related to greater improvements in parent-reported change for ADHD inattention (severity $r = .68$, $p \leq .05$; count r = .65, $p \leq .05$), hyperactivity severity ($r = .57$, $p \leq .10$), combined symptom severity and count ($r = .71$, $p \leq .05$ and $r = .78$, $p \leq .05$), empathy ($r = .86$, $p \leq .01$), engagement ($r = .63$, $p \leq .05$), autism spectrum ($r = .61$, $p \leq .05$), and a trend for social skills standard score ($r = .54$, $p \leq .10$). However, high

Table XIX. Intent-to-Treat Analysis: Bivariate Correlations between Baseline Participant Characteristics and Change Scores for Selected Outcomes in the Treatment Group[a,b]												
	DISC-IV Diagnosis[c]			Parent/Teacher DBD Rating Scale Baseline Symptom Severity[d]					Parent/ Teacher Baseline IRS[d]	Demographics		
	ADHD	ODD	CD	ADHD Inattentive	ADHD Hyperactive	ADHD Combined	ODD	CD	Overall Impairment	Age	Gender[e]	BMI %ile
Change Scores for Cognitive Outcomes												
Automated Working Memory Assessment System (AWMA)												
Verbal ST Memory SS	-.11	.07	-.04	.07	-.39	-.21	.01	-.22	-.21	.14	-.47*	-.10
Verbal ST Memory %ile	-.06	-.13	-.01	-.19	-.55**	-.45*	-.08	-.47*	-.23	-.06	-.25	.24
Verbal WM Processing SS	-.31	.05	-.07	.01	.40	.28	.19	.52**	-.07	.15	-.06	-.35
Verbal WM Processing %ile	-.43	-.10	-.13	-.18	.41	.18	.13	.48*	-.18	.02	.08	-.27
Visuospatial ST Memory SS	-.14	-.22	-.28	.51**	-.02	.25	-.31	-.39	.47*	.32	.04	-.12
Visuospatial ST Memory %ile	-.08	-.22	-.28	.50**	-.08	.20	-.21	-.40	.55**	.41	.03	-.06
Visuospatial WM %ile	-.34	-.60**	-.70***	.09	-.13	-.04	-.17	-.26	.29	.22	.27	-.54*
Visuospatial WM Processing SS	-.46*	-.67***	-.67***	.02	-.13	-.08	-.18	-.19	.40	.32	.23	-.49
Visuospatial WM Processing %ile	-.49*	-.63**	-.68***	.03	-.15	-.08	-.10	-.14	.34	.30	.20	-.53*
Behavioral Rating Inventory of Executive Function (BRIEF)												
Inhibit – T-Score	.17	.15	.03	.01	.54*	.32	.04	.16	-.15	.00	-.04	.26
Org. of Materials – T-Score	.31	.20	.20	.17	.54*	.40	.16	.38	-.12	-.05	.26	.22
Change Scores for Behavioral Outcomes												
Parent Disruptive Behavior Disorder (DBD) Rating Scale												
ADHD Inattentive Severity	.56*	.18	.10	.67**	.68**	.72**	-.21	.12	.33	.10	.23	.12
ADHD Hyperactivity Severity	.03	.07	-.12	.04	.57*	.33	-.11	.03	-.30	-.23	-.22	.47
ADHD Combined Severity	.32	.14	-.02	.39	.71**	.59*	-.18	.08	.00	-.11	-.00	.33
ODD Severity	-.04	.09	-.18	-.41	.13	-.15	.07	-.08	-.57*	-.75**	-.03	.47
ADHD Inattentive Symptoms Endorsed	.55*	.28	.29	.61*	.61*	.65**	-.18	.22	.37	.37	.12	.10
ADHD Combined Symptoms Endorsed	.35	.28	.18	.35	.73**	.58*	-.14	.22	.01	.04	-.06	.36
Parent Impairment Rating Scale (IRS)												
Overall Impairment[d]	.19	-.48	-.59*	-.11	-.39	-.27	-.75**	-.75**	.42	-.20	-.22	.30
Domains Endorsed	-.49	-.57	-.68**	-.41	-.48	-.47	-.32	-.76**	-.37	-.02	-.14	.79**
Social Skills Improvement System (SSiS)												
Cooperation	.37	.54*	.51*	-.01	.23	.13	.37	.53*	.05	-.27	.11	.70*
Assertion	.36	.38	.21	.24	.07	.16	-.19	.04	-.28	-.41	.53*	-.11
Responsibility	-.03	.34	.32	.37	.48	.46	.19	.46	-.05	-.02	.54*	-.40
Empathy	.27	.50*	.38	.62**	.86***	.81***	.55*	.45	.44	.33	.10	-.11
Engagement	.12	.29	.16	.12	.63**	.43	.20	.25	.03	-.18	.06	.66*
Communication	-.17	-.26	-.24	-.07	-.26	-.19	-.11	-.18	-.43	-.50*	.26	-.04
Externalizing	-.05	.08	-.07	-.52*	-.16	-.35	-.10	-.17	-.15	-.29	-.08	.27
Autism Spectrum	-.09	.27	.13	.15	.61**	.43	.23	.21	.06	-.03	.14	.10
Problem Behaviors %ile	.01	.01	-.10	-.43	.03	-.20	-.32	-.04	-.42	-.54*	.14	.45
Social Skills SS	.22	.45	.35	.30	.54*	.46	.14	.38	.01	-.19	.48	.08
Behavioral Observation of Students in Schools (BOSS)												
% Engaged Time	.23	.11	.62	-.34	.43	.03	.73*	.47	.20	-.56	.81*	-.90
% Time Off-Task Motor	.09	.72	.90**	-.01	.50	.41	.12	.80	-.39	-.29	.06	.24
% Time Off-Task Verbal	-.44	-.78	-.94**	-.52	-.23	-.64	-.13	-.55	.24	.18	.13	-.12

Table XIX. Intent-to-Treat Analysis: Bivariate Correlations between Baseline Participant Characteristics and Change Scores for Selected Outcomes in the Treatment Group (continued)[a,b]												
	DISC-IV Diagnosis[c]			Parent/Teacher DBD Rating Scale Baseline Symptom Severity[d]					Parent/ Teacher Baseline IRS[d]	Demographics		
	ADHD	ODD	CD	ADHD Inattentive	ADHD Hyperactive	ADHD Combined	ODD	CD	Overall Impairment	Age	Gender[e]	BMI %ile
Change Scores for Academic Outcomes												
Curriculum-Based Measure (CBM)												
Reading Comprehension - Correct	-.19	.08	.15	.05	-.59*	-.29	-.14	-.24	.45	.78***	.24	.09
Reading Comprehension - Errors	.48	.36	.28	-.24	.29	.02	.16	.04	-.35	-.62**	-.36	.33
Academic Records												
Overall GPA[f]	.41	-.09	-.21	-.11	.06	-.02	-.06	-.26	-.24	-.53**	-.35	.45

Note: * = $p \leq .10$, ** = $p \leq .05$, *** $p \leq .01$; *r* and *p*-values reflect bivariate correlations between participation indicators and change scores (posttest value – baseline value) in selected outcomes (all outcomes not presented were not significantly correlated to participation indicators); positive values have been assigned to correlations in the adaptive direction, and negative correlations to those in the maladaptive direction.

a. Acronyms: BRIEF = Behavioral Rating Inventory of Executive Function – Parent Version, SSiS = Social Skills Improvement System – Parent Version, IRS = Impairment Rating System – Parent Version, DBD Rating Scale = Disruptive Behavior Disorders (DBD) Rating Scale – Parent Version, ADHD = Attention Deficit Hyperactivity Disorder, ODD = Oppositional Defiant Disorder, CD = Conduct Disorder, AWMA = Automated Working Memory Assessment System, BOSS = Behavioral Observation of Students in Schools, DISC = Diagnostic Interview Schedule for Children

b. Average % Max HR = Daily average percent of maximum heart rate (HR) achieved during intervention

c. 0 = Negative Diagnosis (DSM-IV criteria not met), 1 = Intermediate Diagnosis (diagnostic criteria not met, but symptoms and impairments present), 3 = Positive Diagnosis = DSM-IV criteria met

d. The higher value among parent and teacher reporters at baseline (if both parent and teacher baseline data were missing parent posttest data were imputed [n = 4])

e. 0 = female, 1 = male

f. Quarter 3 – Quarter 1

hyperactivity severity trended with decrements in reading comprehension progress (r = -.59, $p \leq .10$). Baseline ADHD combined severity was related to improvements in inattention (severity r = .72, $p \leq .05$; count r = .65, $p \leq .05$), combined symptoms (severity r = .71, $p \leq .05$; count r = .73, $p \leq .05$), and parent-reported empathy on the SSiS (r = .81, $p \leq .01$), while being maladaptively related to change in verbal short-term memory percentile (r = -.45, $p \leq .10$).

Baseline ODD and CD symptom severity were related to decrements in change scores across a number of outcomes. The only significant adaptive relationships were between higher CD and AWMA Verbal Working Memory Processing (standard score r = .52, $p \leq .05$, percentile r = .48, $p \leq .10$), SSiS Cooperation (r = .53, $p \leq .10$) improvements; and higher ODD with trends towards greater gains in empathy (r = .55, $p \leq .10$) and percent time engaged during classroom observations (r = .73, $p \leq .10$).

In the treatment group, younger children seemed to made greater gains across a variety of outcomes including, ODD severity (r = -.75, $p \leq .05$), SSiS Communication (r = -.50, $p \leq .10$), SSiS Problem Behavior Percentile (r = -.54, $p \leq .10$), and MAZE reading comprehension errors (r = -.62, $p \leq .05$), and overall GPA (r = .53, $p \leq .05$) but greater errors on the MAZE reading comprehension test (r = .78, $p \leq .01$) compared to older children. Boys evidenced trends towards greater gains in parent-reported assertion (r = .53, $p \leq .10$) and responsibility (r = .54, $p \leq .10$), and increased (Allen 1980) percent time engaged in classroom observations (r = .81, $p \leq .10$) but lower gains in verbal short-term memory (standard score r = -.47, $p \leq .10$; percentile r = -.25, $p \geq .10$) than girls in the treatment intervention. Finally, children with higher BMI percentiles derived greater benefits in number of domains reported as impaired by parents (r = .79, $p \leq .05$), parent-reported cooperation (r = .70, $p \leq .10$) and engagement (r = .66, $p \leq .10$) but smaller gains in visuospatial working memory (r = -.54, $p \leq .10$) and visuospatial working memory processing (standard score r = -.49, $p \geq .10$; percentile r = -.53, $p \leq .10$) than children with lower BMI percentiles in the treatment intervention.

V. DISCUSSION

The objectives of this study were to test the feasibility and impact of a 10-week after-school physical activity intervention for children with ADHD and DBD. Children were randomized to either a physical activity group or a sedentary attention control group. A modified multiple gating procedure was utilized to identify and recruit eligible children, and along with direct recruitment, yielded strong interest and enrollment in the after-school program. Objective and subjective measures of cognitive, behavioral, and academic functioning were collected at baseline and posttest and group differences over time explored in analyses.

This study adds to the previous literature through enrollment of a low-income underrepresented minority sample, randomization of participants to condition, presentation of intent-to-treat analyses, blinding of data collectors to study condition, rotation of instructors across groups, a sample size larger than prior studies in this population, collection of multiple potential confounders, utilization of an adherence measures (i.e., HRMs), conceptually relevant established objective and subjective outcomes measures, a comparable but sedentary attention control condition, and a parent diagnostic interview (DISC-IV-P). The utilization of a comparable but sedentary attention control condition made the study design utilized for this trial the most stringent possible test of the executive control hypothesis in this population. The attention control condition participated in a comparable but sedentary intervention with the same staff, duration, behavior management strategies, and participation in activities. Activities ranged from, chess, clue, Legos, checkers, dominos, charades, battleship, drawing, painting, and connect 4, and all of the aforementioned activities utilized executive functions.

A. Feasibility

The current intervention successfully recruited and retained over 50 students, 43 of whom met criteria for positive and intermediate diagnosis for ADHD and DBD, and all of whom navigate the daily stresses and challenges associated with urban poverty. The enrollment of children with ADHD and DBD

was smaller (n = 43 vs. n = 50) than had been hoped for based upon recruitment through the multiple gating procedure in a previous study at Robert Emmet Elementary conducted by Dr. Atkins in 2007 (Consultant and Dissertation Committee Member). However, the school population dropped substantially from 568 to 426 between 2010 (when the grant was proposed) and 2013 (when the intervention was conducted).

Nevertheless, the size of the current study is comparable to other PA interventions for ADHD in the literature where sample size has ranged between n = 14 and n = 32 (Kang et al. 2011; Halperin et al. 2012; Smith et al. 2013; Verret et al. 2012). The largest of these, Kang et al. (2011), enrolled 32 children with ADHD diagnoses and included 28 of them in the data analysis. An important difference here is that the current study also enrolled children with DBD. Project Play enrolled 22 students with ADHD positive diagnoses, and 13 students with intermediate diagnoses, according the DISC-IV-P, therefore, 35 students on this continuum participated. In the broader literature of RCTs examining the influence of PA on cognition in children, the current study is on the smaller side as studies have ranged in size between *n* = 32 (*n*= 23 analyzed) (Chaddock-Heyman et al. 2013) and to *n* = 171 (all analyzed) (Davis et al. 2011).

This study utilized an evidence-based PA intervention (Davis et al. 2007; Davis et al. 2011) and adapted it for children with ADHD and DBD. The major modification was the addition of a series of evidence-based behavior management strategies, which have been utilized in previous work by Drs. Frazier and Atkins in Chicago urban poor communities (Atkins et al. 2003; Frazier, Cappella, and Atkins 2007; Frazier, Chacko, et al. 2012). These strategies were continually refined over the course of the trial with consultation from two clinical child psychologists (Drs. Frazier and Rusch) in order to achieve study participation goals. The efficacy of the intervention developed here is buoyed by the absence of maladaptive time effects across measures in both groups, and the largely adaptive correlations between attendance and study outcomes.

Results demonstrated the feasibility of the Project Play intervention, achieving its attendance (≥ 3-days/week), retention (80%), and falling slightly short on its average percentage of MHR (75% MHR) and daily HRM duration (≥ 40-min.) goals in the ITT analysis. Attendance rates were substantially decreased by students that were expelled or withdrew from the intervention in the ITT analysis and rose sharply in the per protocol analysis. Parent and child focus groups reflected widespread program satisfaction with both groups emphasizing their appreciation for the diversity and passion of the staff and the opportunity for adult-supervised social interaction between students. The former speaks to the potential viability of a staffing model of graduate and undergraduate student instructors, utilized in ADHD summer camps previously (Pelham and Hoza 2005), in urban poor communities with staff outside the field of psychology. However, the short duration of the project (10-weeks) was likely a contributing factor to the feasibility of the model and subsequent studies should examine feasibility of a longer intervention. In the case that future iterations are undertaken for longer durations, such as a full school year, acquisition of a full-year commitment from students, and staffing during final examinations and breaks would need to be addressed.

This study achieved an average HRM duration of 29-minutes/day in the treatment condition. Which is less than the HRM durations of ≥ 40-minutes/day, which evidenced benefits in previous studies (Davis et al. 2007; Davis et al. 2011; Verret et al. 2012). This shortcoming appears to have been logistical, in order for a student to view their HR or duration without stopping the recording on the HRM model used they had to touch the watch to the chest strap without hitting the button. Although this was reiterated daily for students, they often prematurely hit the button, either by accident of in an attempt to see their HR, which automatically stopped the recording. Once the students hit the button again to restart the recording the previous data was deleted and the monitor began recording anew recording. A few

students also consistently removed their chest straps mid-exercise because they said they were uncomfortable.

An alternative explanation for the short HRM durations is that because points were awarded for HR average but not duration, some students figured out that if they stopped the HRM after having recorded low HRs at the beginning of structured play and then exercised vigorously for a short duration that they would get more tickets. Fortunately, the average HRM duration does not reflect the actual daily duration of physical activity in the treatment intervention as students were supervised by study staff in the gymnasium for 60-minute of structured play each day followed by 30-minute of free play. In future iterations of the program, placing tape over the face of the HRM, utilizing a monitoring system that only requires students to wear the chest strap, and requiring a minimum HRM duration to award tickets may remedy this shortcoming.

B. Impact

1. Within-Group Time Effects in the Treatment Group

Within-group time effects are not always of interest in RCTs because it is impossible to tell whether the effects identified are due to the intervention or secular effects (e.g., aging, classroom instruction). However, because the literature on physical activity for ADHD and DBD is only in its infancy and 40% of the intervention studies have been single group uncontrolled trials (Halperin et al. 2012; Smith et al. 2013), within-group time effects are included in the current study.

With regard to cognitive outcomes, Smith et al. (2013) reported small within group time effects (range of d = -.10 to .36, ps $\leq$ .05) in per protocol analyses on the Shape School inhibition task in their sample of children with ADHD following an 8-week intervention (Smith et al. 2013). Results on the STOP-IT task, a conceptually related neurocognitive inhibition task, in the current study are in line with those of Smith et al. (2013) with small but significant effects in both the treatment (d = .27, $p \leq .05$) and

attentions control (d = .21, $p \leq .05$) groups in the per protocol analysis. Smith et al. (2013) also reported a small within-group time effect (d = .43) on a verbal working memory task, Digit Span Backwards (Smith et al. 2013). This effect was exceeded in the current study's treatment group on the AWMA Verbal Working Memory Task (range of d = .50 to .76) in per protocol analyses.

Behaviorally, both Smith et al. (2013) and Halperin et al. (2012) reported within group time effects for parent-reported behavioral outcomes in the physical activity interventions for children with ADHD. Smith et al. (2013) reported significant small-moderate improvements (d = .40 to .70, ps $\leq .06$) for teacher reports of hyperactive, inattentive, oppositional, and impulsive behavior on the Pittsburgh Modified Conner's Teacher Rating Scale (PMCTRS) in per protocol analyses (Smith et al. 2013). In an ITT analysis, Halperin et al. (2013), demonstrated moderate significant improvements (d = .55 to .58, all ps $\leq .01$) in parent-reported ADHD symptom count and severity on the Attention Deficit Hyperactivity Disorder Rating Scale IV (ADHD-RS-IV) following their parent training intervention (Halperin et al. 2012).

Analyses on the current sample revealed significant moderate-large within-group effect sizes on ADHD outcomes in the treatment group using the Parent DBD Rating Scale (a measure conceptually similar to the PMCTRS and ADHD-RS-IV) in both the per protocol (d = 0.52 to 1.96, all ps $\leq .05$) and ITT analyses (d = .67 to 1.10, all ps $\leq .05$). Halperin (2013) also reported small non-significant changes (d = .45, p .13) in parent-reported in impairment on the Children's Problems Checklist (CPC) in ITT analyses following their parent training program. In ITT analyses, the treatment group in the current sample evidence moderate-large significant effects in both parent-reported domains endorsed ($p \leq .05$; d = 1.49) and overall impairment ($p \leq .05$; d = 0.73) on the IRS.

Neither study presented academic outcomes and results in this domain were the weakest for the treatment group with near complete absence of significant time effects in either analysis in this domain.

Time effects in the treatment group compare favorably to findings reported in previous studies. These findings together with the myriad of other cognitive and behavioral outcomes that demonstrated significant time effects in this study but not measured in previous physical activity interventions in this population suggest that participants in the physical activity intervention derived benefits equivalent to or exceeding those of prior interventions. This conclusion must of course be tempered by the reality that these are within-group time effects and therefore we cannot know conclusively that the intervention was the cause of the improvements in this sample instead of other plausible factors such as learning effects, maturation, and effective classroom teaching during the school day.

2. Between Group Effects

While within group time effects demonstrated near universal improvement across cognitive and behavioral outcomes in line with the previous literature. Results of the current study diverge from previous PA interventions in children with ADHD and DBD when data are examined between groups. The primary outcome in the current study, the BRIEF GEC, did not reach significance between groups over time, evidencing only small non-significant effects in favor of treatment in the ITT (*t*-score $d = .22$, $p = .734$; percentile rank $d = .22$, $p = .788$) and per protocol analyses (*t*-score $d = .29$, $p = .659$; percentile rank $d = ..47$, $p = .504$). The null finding here was primarily due to dramatic improvement on the outcome in the control group who improved their percentile rank by 16.21% vs. the treatment group's improvement of 21.71% in ITT analyses and 20.91% vs. 32.96% in the per protocol analysis.

In both the ITT and per protocol analyses, the trend evidenced in the primary outcome of improvement within both groups but no significant differences between groups was evident in the majority of exploratory cognitive and behavioral outcomes in both analyses. In contrast, within group improvements were virtually absent among academic outcomes in both analyses. This weakening of effects moving from cognitive to academic outcomes is in line with the study's conceptual model (see

Figure I) in which academic outcomes are the most distal from the intervention. However, the lack of findings in the academic domain are likely also a consequence of the analytical approach chosen for academic records in which the academic quarter after the intervention was compared to the academic quarter prior to the intervention. This represents a more stringent test of the hypothesis than comparing the quarter in which the intervention took place and daily homework support was provided with the quarter prior.

In the ITT analysis, only one outcome reached statistical significance between groups over time, the Internalizing Subscale of the SSiS (AMD = -0.66, 95% CI = -1.20 to -0.11, $p \leq .05$, $d = 1.27$). While many of the SSiS subscales evidenced only poor to acceptable reliability, the Internalizing subscale had good internal consistency at baseline ($\alpha = .85$). There was also a trend towards significance in this subscale in the per protocol analysis (AMD = -0.63, 95% CI = -1.29 to -0.03, $p \leq .10$, $d = 0.87$). However, this effect disappeared once the baseline difference between groups on having a best friend was entered into the model as a covariate (AMD = -0.58, SE = 0.35, $p = .112$).

In the per protocol analysis children in the treatment group were significantly less likely to have a best friend at baseline (parents of 30% of children in the treatment group reported their child did not have a best friend vs. 0% of parents in the control group). The mediating effect of this variable suggests that what initially appeared to be an effect of physical activity in this subsample was partially an effect of students in the treatment group not having but gaining a best friend through the program (18.2% of control group parents and 22.2% of treatment group parents reported their child did not have a best friend at posttest).

Having a best friend at baseline was also entered as a covariate into the ITT analysis despite not reaching significance at baseline there ($p = .053$) because of the per protocol finding and research suggesting that children with ADHD and DBD experience difficulty in peer relationships and have

evidenced improved behavior with friendship forming (Hoza et al. 2003). The significant group by time interaction in the ITT analysis for the Internalizing subscale remained significant even after inclusion of this covariate (data not shown).

This finding is both impressive and complies with the extant literature on physical activity and mental health. The utilization of an attention control condition made this a highly conservative test of the impact of physical activity, as it controls for the myriad of mental health benefits associated with play, structured programming, behavior management tools, and peer and staff social interaction. At the same time, the Internalizing Subscale has items referring to anxiety, depression, and self-esteem and while these are not the primary outcomes of interest in ADHD or DBD (both externalizing disorders), the anxiolytic and antidepressive benefits of physical activity are the most well-documented benefits in the literature (Rimer et al. 2012) and this finding supports a recent controlled trial of children with ADHD, which observed a trend for withdrawn-depression score on the CBCL (Verret et al. 2012). This finding provides additional evidence that the antidepressive and anxiolytic effects of physical activity generalize to children with ADHD and DBD and indicates that physical activity may have an important role to play in tertiary prevention in this population.

In the per protocol analysis of exploratory outcomes, group x time interactions reached significance. However, trends emerged in favor of the treatment group for AWMA Verbal Short-Term Memory (standard score $p \leq .10$, $d = 0.46$; percentile $p \leq .10$, $d = 0.38$), the Internalizing Subscale of the SSiS ($p \leq .10$, $d = 1.27$), and Music GPA ($p \leq .10$, $d = 0.79$), all of which fell below $p \leq .10$ after controlling for baseline differences between groups on participant characteristics and participation indicators. In contrast, the Autism Spectrum Subscale of the SSiS (AMD = 0.53, 95% confidence interval = 0.00 to 1.07, $p \leq .10$, $d = -1.38$) trended in favor of the control condition and the trend remained even after controlling for baseline characteristics and participation indicators.

The SSiS Autism Spectrum Subscale contains a number of items related to verbal communication, such as "shows concern for others," "starts conversations with peers," "takes turn in conversations," "responds well when others start a conversation or activity," "invites other to join in activities," and "makes eye contact when talking." Although both groups improved from baseline to posttest on this outcome the improvement was much greater in the control group. A potential insight here, and one that was anecdotally noted by the Project Play staff, is that one advantage of sedentary games and activities relative to physically active ones is that there is much more opportunity for dialogue between students and their peers and students and staff when everyone is seated at a quiet table vs. exercising in a noisy gym. The findings favoring the control group on this measures may reflect this difference. Unfortunately, baseline reliability for the SSiS Autism Spectrum Subscale was questionable ($\alpha = .60$), which predisposes the outcome to type I errors and therefore this finding must be interpreted with caution.

Between group effect sizes followed the conceptual model (see Figure I) in both ITT and per protocol analyses. Small to moderate effect sizes favoring the treatment group were evident across nearly all cognitive outcomes with the exception of AWMA visuospatial short-term and working memory all of which favored the control group with non-significant moderate to large effects. This finding may reflect previous literature suggesting that EF benefits gained are highly specific to training (Diamond and Lee 2011; Diamond 2013). In this case, arts and crafts activities and board games (e.g., memory) may place more stress on visuospatial working memory than physical activity.

On behavioral outcomes between group effect sizes were more variable, with small to large effects evident in both directions in equal proportion. Parent reports of symptoms and impairment demonstrated essentially equivalent improvement in both groups. For the Attention Control condition moderate non-significant effects were favorable for both the Empathy (ITT $d = -0.51$; per protocol $d = -$

0.66) and Hyperactivity/Inattention Subscale SSiS Subscales (ITT *d* = -0.37; per protocol *d* = -0.63), percentage of time off-task verbal on the BOSS (ITT *d* = -0.74; per protocol *d* = -0.89), and suspensions (ITT *d* = - 0.92; per protocol *d* = 0.00) and days suspended (ITT *d* = -0.92; per protocol *d* = 0.00) .

Both of the SSiS subscales identified here evidenced acceptable reliability and may reflect adaptations to consistent reinforcement in a sedentary structured environment in which more refined communication and cooperation are necessary to effectively play games. For example, a board game does not function if students do not take turns or communicate rules to one another concisely; indeed games such as charades and dominos are predicated completely upon successful communication. The same is true for physically active games but they are more robust against children breaking rules (e.g., a game of tag continues even if some individuals cheat and a relay race continues even if someone runs out of turn) and more advanced physically active games involving strategy were not feasible with this sample. The BOSS and suspensions findings, however, must be interpreted with caution. The sample size for the BOSS at baseline was very small in the treatment group (ITT *n* = 6; per protocol *n* = 4) and the values were significantly different between groups at baseline in the ITT analysis. Similarly, there was only one student suspended in the ITT sample.

Moderate-large effect sizes in favor of the treatment group were evident for the Assertion (ITT *d* = 0.90; per protocol *d* = 1.01) and Responsibility (ITT *d* = 0.50; per protocol *d* = .67) subscales of the SSiS. The former evidenced poor reliability at baseline (α = .55) and includes items reflecting confidence, such as asking questions and standing-up for oneself and others. The latter evidenced only questionable reliability at baseline (α = .66) and is composed of items related to behaving when unsupervised, taking care of and respecting other people and their belongings, and following through on promises. These findings are in line with documented benefits of physical activity in non-disruptive youth, however, the assertion result seemed to be driven by a decrease in reported assertiveness in the

control group rather than an increase in the treatment group (neither group changed significantly from baseline to posttest on this outcome). The responsibility outcome may reflect greater agency and opportunities for leadership among participants in activities in the treatment group relative to the control group. For example, games in the treatment group tended to involve more teamwork and competition than control activities. Nevertheless, the suboptimal reliability associated with these subscales suggests that these data should be interpreted with caution.

Among academic outcomes, effect sizes were largely small and sporadic with the exception of World Language (ITT d = -0.51, per protocol d =-0.44) and Physical Education (ITT d = -1.87, per protocol d = -1.17) where the control group evidenced advantages due to drops in these grades in the Treatment Group; and Mathematics GPA (ITT d = 0.22, per protocol d = 0.54), Art GPA (ITT d = 0.22, per protocol d = 0.62), and Music GPA (ITT d = 0.09, per protocol d = 0.79) where values stayed the same or dropped in the control group but rose in the treatment group in per protocol analyses.

The Physical Education, Music, and Art GPA outcomes were all nonnormal and therefore must be interpreted with caution. However, it is possible that in the case of physical education and art each group came to associate that space and activity with play that is less structured than classroom instruction in those subjects. Finally, while previous research has demonstrated a benefit of physical activity for math performance (Davis et al. 2011), math was measured directly through the CBM in this study and group by time effect was small, nonsignificant, and favored controls.

Perhaps, the most striking finding in the current study was the null findings across outcomes that conflict with the current literature. The earliest controlled physical activity intervention in this population, McKune (2003), non-randomly assigned children to a physical activity intervention or a no-intervention control and failed to demonstrate between group differences over time. The authors attributed the lack of significance between groups over time to improvement in outcomes in both groups

partially stemming from increased attention paid by parents and teachers to their children during the intervention. This explanation was based upon research demonstrating that the presence of ADHD in children is closely associated with disrupted parent-child relationships (Johnston and Mash 2001) and parent-child conflicts (Burt et al. 2003). This seems like a plausible explanation and perhaps applicable to the current study as it was not uncommon to hear a child that misbehaved during school being scolded by a teacher and administrator with the phrase "… and you are in Project Play, we expect more from you." Nevertheless, the McKune study was very small, 13 students in treatment and 6 in control, between-groups results were not presented, and the study was the methodologically weakest published study in the literature to date and two more recent and rigorous controlled trials found significant improvements between groups over time.

Verret et al. (2012) non-randomly assigned 21, 7- to 12-year-olds to either a 3-time/week 10-week physically active program during lunch time, or a no-intervention control. Significant group x time effects were reported for tasks of sustained attention and information processing (Sky Search), and parent and teacher-reported total problems, and social, thought, and attention subscales of the CBCL (116). Similarly, Kang et al. (2011) randomizing 32 children with ADHD to a biweekly 6-week sports therapy group or an education control group. Significant group x time interactions emerged for working memory (digit symbol score) and cognitive flexibility (trail-making test-B) in per protocol analyses on 28 children that adhered to the program. Parent behavior report on the Social Skills Rating Scale (SSRS) revealed significant differences between groups on the raw score of the Cooperativeness Subscale. Comparable outcomes to these in the current study, including parent reports of ADHD and DBD symptom and impairment, cooperativeness, inhibition, working memory, and behavioral manifestations of EF yielded null results between groups over time.

A critical difference between these two studies and the current study is the utilization of a comparable sedentary attention control condition. This adaptation controls for the benefits of play, social interaction, exposure to prosocial staff, behavior management strategies, removal from potentially negative exposures, and a myriad of other factors associated with structured programs which challenge aspects of EF. For example, stress has been demonstrated to impair EF (Diamond 2013), and it may be the case that simply having a routine safe place to go after school provides a tremendous benefit to children in an environment where these practicalities are sometimes not readily available. Comparison to a no-intervention control or otherwise unequal control may not adequately control for this confounder.

Interestingly, a recently completed RCT by Krafft et al. (in press), utilized an equivalent attention control comparison group to this study and also yielded null results on a neurocognitive task of working memory with a larger community sample of overweight children (Krafft et al. In Press). This finding is in conflict with other studies in non-disruptive children demonstrating greater gains in cognition in physical activity intervention participants vs. no-intervention controls (Chaddock-Heyman et al. 2013; Davis et al. 2007; Davis et al. 2011; Kamijo et al. 2011). Taken in combination the null findings in the current study and Krafft et al. (in press) raise the possibility that the extant literature may be erroneously attributing differences between physical activity intervention groups and no-intervention controls and unequal sedentary controls to neurobiological consequences of physical activity (Dishman 2006; Hillman, Erickson, and Kramer 2008; Gapin, Labban, and Etnier 2011) when in fact these findings may be due to other factors related to participation in any structured program vs. non-participation (Krafft et al. In Press; McKune, Pautz, and Lombard 2003).

This possibility is true for both the literature in ADHD and/or DBD (Kang et al. 2011; Smith et al. 2013; Verret et al. 2012) and non-disruptive children (Chaddock-Heyman et al. 2013; Davis et al. 2007; Davis et al. 2011; Kamijo et al. 2011) and is in line with the literature on EF interventions

generally, which demonstrate that diverse activities, including computer programs, tae kwon do, non-computerized games, martial arts, yoga, mindfulness, and school curricula improve EF relative to attention control conditions using randomized-controlled designs and intent-to-treat analyses (Diamond and Lee 2011). The takeaway from that literature is that almost anything that stresses EF generates adaptations in EF specific to the dimension that was stressed (Diamond 2013). In this case, it may be very difficult to generate an engaging, high quality, structured after-school program with rules and goals and social activity that does not improve EF.

Unfortunately, methodological limitations in this feasibility study preclude any definitive conclusions regarding the impact of physical activity on cognitive and behavioral functioning in children with ADHD and DBD, beyond that we failed to detect the effect here. That being said, some findings, such as consistent small effects in favor of the treatment condition on cognitive outcomes and correlations between average percentage of MHR and cognitive and behavioral outcomes in the treatment group suggest the possibility that a larger simple size may have detected small to moderate between group effects on these outcomes.

3. Correlations between Participation Characteristics, Participation Indicators, and Change Scores

In order to preliminarily explore the impact of the program in within-group time effects and potential moderators of program impact correlations were run between participant characteristics, participation indicators, and change scores in the ITT analysis. When attendance was combined across groups, higher attendance was unrelated to neurocognitive tasks but consistently adaptively related to parent-reported EF on the BRIEF, including the BRIEF GEC. The effect on neurocognitive tasks was driven by the control group where higher attendance was strongly related to greater improvements. Combined attendance was also modestly related to improvements in symptoms severity and impairment and this effect was driven more by the treatment group. Behavior observation and academic effects were

largely unrelated to attendance with the exception of change in overall GPA, which demonstrated large correlations with treatment ($r = .56$, $p \leq .05$) and combined ($r = .50$, $p \leq .05$) attendance. This finding is impressive because the GPA values compared were not between GPA during the program and GPA prior but rather GPA for the academic quarter following the program and GPA prior to the program.

Associations between average percentage of MHR and change scores in the treatment group were in accord with the conceptual model. Large correlations were evident between higher HR during the intervention and improvements in neurocognitive tasks ($r = .31$ to $.81$) but associations did not consistently extend to behavioral or academic outcomes. This finding is in accord with the literature demonstrating the neurocognitive benefits of physical activity in children, older adults, and animal models. However, the HRM values evident here may be a proxy for program participation more generally, one had to be following directions and playing by the rules to increase HR in the intervention.

The most consistent theme in correlations between participant characteristics and change scores was that lower baseline values on outcomes related to ADHD were related to greater improvements in outcomes related to that disorder. ODD and CD diverged slightly from this trend. Children with CD diagnosis or higher baseline severity for CD did not evidence greater improvements in CD severity than children with lower CD severity at baseline in either group. Similarly, in the treatment group, ODD diagnosis and higher baseline ODD severity were not related to greater gains in ODD-related outcomes and were related to significantly smaller changes in overall impairment than students with lower ODD scores at baseline (ODD diagnosis $r = -.57$, $p \geq .10$; ODD severity $r = -.75$, $p \leq .05$). This result is in contrast to the control group where a large adaptive correlation ($r = .58$, $p \leq .05$) was evident for students with ODD and ODD was unrelated to changes in impairment.

These findings suggests that children with CD received less of a benefit from the program than their non-CD peers, likely because they were more likely to be frequently suspended, and ultimately be

expelled or withdraw. By definition children with CD are also likely to be older and higher age was also maladaptively related to change scores in both groups. Future iterations of the intervention will need to either exclude older students and students with CD or make substantial changes to ensure that a better service is delivered. This is a difficult negotiation as programs must balance between providing a service to older students with high needs and simultaneously maintaining the efficacy and integrity of the program for younger students and non-CD students.

The slight difference in findings between groups on ODD may suggest that for children with a greater tendency for rule-breaking behaviors and violations of the rights and privileges of others, sedentary activities may be a more conducive environment for growth than physically active ones. Specifically, there are greater opportunities for misbehavior in a large gym with children and staff running around than in an arts and crafts program where children are mandated to be in their seats at all times. Misbehavior will lead to greater punishments and fewer reinforcements for positive behavior, which would lead to inferior improvements for these students. That being said, the finding here was not that children with ODD in the treatment group or CD in both groups evidenced worse improvements in CD and ODD severity than their peers, only that they did not obtain greater gains than their non-ODD/CD peers.

Finally, exploratory analyses of demographics were presented. As noted above, younger age was related to greater improvements in some outcomes, especially those related to changes in ODD, CD, and problem behaviors. Gender was unrelated to outcomes in both groups, suggesting an equivalent benefit across groups. Finally, children with greater BMI percentile evidence significantly greater improvements in reading comprehension in the control group and overall impairment in the treatment group than children with lower BMI percentile at baseline. Children with higher BMI appeared to have greater gains in behavioral outcomes generally relative to lower BMI peers in the treatment group but

not the control group. This finding suggests that children with higher BMI and behavioral disorders may derive greater behavioral benefit from physical activity programs than comparable sedentary ones. Presumably, these improved benefits may be derived from improvements in physical health, self-confidence, and body image for overweight and obese children (Schneider, Dunton, and Cooper 2008; Spence, McGannon, and Poon 2005).

C. Limitations

Results of this study need to be interpreted within the confines of the its limitations. The intervention was shortened by one week (week 12) after the CTU teacher's strike and suspended one week (week 9) during ISAT testing (see Figure III. Intervention Timeline). This shortened the duration from 12-weeks to 10-weeks and also unbalanced the staff rotations (4-weeks vs. 6-weeks instead of 5-weeks vs. 5-weeks), which raises the possibility that differential exposure to staff were responsible for differences observed. However, the staff was well-matched in-terms of experiences and qualifications in working with children and all students saw and interacted with study instructors in the building even during weeks when staff did not facilitate their group.

The shorter duration also decreases the magnitude of fitness benefits obtained, however, because the PACER (fitness test) was only conducted at baseline, thus gains in overall fitness cannot be determined, this concern is compounded by potentially lower exercise intensity than was proposed for the intervention. Despite meeting our goal of 75% MHR, our daily mean HR in bpm ($M = 141.32$, $SD = 14.79$) is lower than other studies and is normally considered in the "moderate" range. This indicates that the %MHR figure may overstate PA intensity in this sample due to having generated lower than expected MHR through the PACER task. For example, Verret et al. (2012) achieved a daily average HR of 154 bpm in a group of ADHD children using a different intervention, which was quantified as 75%

MHR. This is important as the literature in children suggests that vigorous physical activity may deliver the greatest cognitive benefit (Kamijo et al. 2004).

Another limitation also involved the HRMs, children prematurely hit the button on the monitor daily, leading to an average HR duration of 28.83-minutes/day in the current study, substantially less than that of the stated goals of ≥ 40-minutes per day. The impact of this duration on interpreting study findings is minimal, however, because the students were unequivocally staff supervised each day in the gymnasium for 60-minute of structured play each day followed by 30-minute of free play.

A more substantive limitation was the sample size. Although this trial is the largest in children with ADHD and DBD to date, it nevertheless enrolled only a small sample. The power analysis for the current study was based upon the best evidence we had in 2010, the first cohort of Dr. Davis' SMART study (Krafft et al. In Press), which was substantially longer than Project Play (8-months vs. 12-weeks) and found in subsequent cohorts that the large effect evident for the BRIEF GEC did not hold.

Unfortunately, the absence of a no-intervention control condition makes the within-group findings difficult to interpret. While ADHD and DBD symptoms and impairment are often characterized by escalating misbehavior (*Diagnostic and Statistical Manual of Mental Disorders (4th ed.)* 1994), we simply cannot know that the improvements evident in each group were due to the intervention and not factors outside of the intervention. Future iterations of the program utilizing a no-intervention or wait-list control as a third group would address this limitation. Unfortunately, this was not possible in the current feasibility study due to time and resource constraints.

The inclusion of subthreshold participants (children meeting criteria only for intermediated diagnosis on the DISC) and students with DBD but not ADHD is an additional concern and may have led to ceiling effects on the cognitive outcomes. This contention was not supported in the data however, as baseline values on EF variables standardized by age and gender were all very low in this sample,

ranging between the 12th and 28th percentile on the BRIEF and the 19th and 36th percentile on AWMA working memory outcomes (Table VI). This is consistent with research suggesting that children in urban poor communities generally suffer from impairments in EF (Diamond 2013; Farah et al. 2006).

It is also important to note that due to scheduling conflicts among baseline data collectors, four additional data collectors were hired for posttest data collection (see Appendix A. Staff Bios). This does not impact interpretation of group x time effects on any outcomes because the same data collectors collected data from each group at the same time points. Additionally, this does not impact time effects for neuropsychological tasks or parent-report data because all of the neuropsychological tasks were completely automated and only required the data collectors to read instructions and hit a button to continue when prompted. Similarly, the posttest parent questionnaires only required the data collectors to read questions aloud and record responses. For the classroom observations one data collector at each time point collected this data and was trained to be within 80% reliability of the PI throughout a full observation on all scales of the measure. However, even that standard leaves room for variation in coding and it is easy to drift on observation tools; therefore, within-group time effects for the classroom observation data should be interpreted with caution.

An additional limitation is the high number of comparisons run (87 comparisons in each analysis) would be expected to yield 4.35 type-I errors in each analysis with an unadjusted classical procedures. We chose a linear mixed effects model in part because of its efficiency and reliability in conservatively handling multiple comparisons. Multilevel models perform partial pooling (shifting estimates toward each other), which generate a correction similar to what is achieved in classical procedures by widening confidence intervals or reducing the *p*-value for intervals of fixed width to compensate for keeping the centers of intervals stationary but do so with greater efficiency and reliability (Gelman, Hill, and Yajima 2009).

A second reason for utilizing the mixed effects model as opposed to ANOVA was to address the substantial missing data at each time point. Especially among parents where data was absent for nine parents at baseline and posttest. In this case, the linear mixed effects model allowed us to use all of the data we have and does not alter or predict values for participants with missing data and does not require that data be missing at random (Bliese 2009), which is unlikely given that less functional and more overburdened parents are less likely to keep appointments. Nevertheless, the substantial missing data among parents at each time point limited the power of the study, but this limitation was conservative as it decreased sample size for those variables and thereby the likelihood of significant findings.

D. Summary and Conclusions

Evidence for the benefits of PA on neurocognitive function are stronger in animal models, older adults, and acute bout studies but less so in children with regular activity, and appear to be independent of physical fitness gains (Basch 2011b; Davis and Pollock 2012; Tomporowski et al. 2008). This viewpoint is contrary to the primary interpretation in that literature that consistent differences demonstrated between PA interventions and no intervention or wait-list controls are attributable to neurobiological changes stemming from regular MVPA (Dishman 2006; Hillman, Erickson, and Kramer 2008). If it is true that regular MVPA independent additional neurocognitive benefits, and the only way to achieve MVPA in kids is to enroll them in a program in which they have to participate in PA, then the only way to isolate effect of PA is to compare it to an equivalent but sedentary condition. That is the test that was conducted here, and if PA carries unique cognitive benefits specifically responsive to aerobic load then we should have seen consistent benefits in the PA group above and beyond the Attention Control group.

To this end, there were no observable benefits of the exercise condition, across nine cognitive, behavioral, and academic measures, only one subscale of one measure reached significance between

groups over time in the ITT analysis, Internalizing Subscale of the SSiS, and only one other subscale of the SSiS, Autism Spectrum, approached significance in the per protocol analysis. The Internalizing Subscale of the SSiS finding is consistent with the most thoroughly studied and widely reported mental health benefit of PA, its anti-depressive and anxiolytic effects (Rimer et al. 2012), and a recent study in children with ADHD (Verret et al. 2012), but is of secondary importance to the EF and externalizing outcomes that characterize ADHD and DBD. Similarly, the Autism Spectrum may reflect a specific training effects of sedentary games and activities on verbal communication and cooperation.

Nevertheless, the sample size, short duration, and substantial missing parent data (n = 9 at each time point), and potentially suboptimal exercise intensity are limitations. Given the null results for group x time interactions in both the ITT and Per Protocol analyses it is not clear whether the interventions, conceptually equivalent but one sedentary and one physically active, carried a similar benefits across measures or whether the PA program had some small-moderate effects relative to the control condition which were too small to detect with the sample size achieved. The former explanation is in line with the literature on EF interventions, which demonstrates that diverse activities, both physically active and sedentary, improve EF, so long as they continually challenge it (Diamond and Lee 2011).

In interpreting these findings it is important to realize that even if a physical activity program only yields equivalent benefits to an equivalent sedentary program on cognitive, behavioral, and academic outcomes this doesn't make physical activity programs in this population obsolete. Quite the contrary, in a context of finite time and resources there is a need for interventions that generate the greatest value for societal investment. Physical activity offers a number of exclusive and well-documented physical and mental health benefits, above and beyond sedentary activities. First, the potential value of acute effects for managing ADHD symptoms should not be undervalued as it has potential to alter daily functioning and medication usage for short periods of time with proper planning (Taylor and Kuo 2009). Second,

physically active games and sports are highly popular among children and provide engaging, emotionally charged activities ripe with opportunities for learning and refinement as a space for nurturing social and emotional growth (Frazier, Cappella, and Atkins 2007; Frazier, Chacko, et al. 2012; Hellison 2000). Third, and perhaps most importantly, physical activity provides a series of protective physical and mental health benefits, which have been thrust to the forefront in the nation's current obesity epidemic(Janssen and Leblanc 2010).

Future research addressing the methodological limitations of the current study, namely, enrollment of a larger sample size, increased exercise intensity, a longer duration, and inclusion of a third no-intervention control group would provide additional insight into the impact of physical activity on cognition, behavior, and academic performance in this population. Similarly, further testing and refinement of the intervention will be necessary to maximize feasibility, effectiveness, cost-effectiveness, and generalizability. Specifically, optimizing the behavior management strategies, maximizing exercise intensity, and being as explicit and effortful as possible about continually challenging EF throughout the program will be key to maximizing impact (Diamond and Lee 2011; Halperin and Healey 2011).

Research investigating the impact of physical activity on outcomes in multiple domains will be critical to obtaining buy-in from key stakeholders and achieving greater levels of societal health and strength. Physical activity programs have exceptional potential as both a tool and space for mental and physical health promotion broadly, and especially in low-income communities. The current study represents a first step in a line of research aimed at making that potential a reality.

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VII. APPENDICES

A. Appendix A
Project Play Staff Bios

Graduate Lead Instructors:

Dana Kroop received her B.A. with Honors in History, Philosophy, and Social Studies of Science and Medicine from the University of Chicago in 2007. She is currently studying for her M.S. in Nursing at the University of Illinois at Chicago (UIC) where she is funded by a UIC College of Nursing Board of Trustees Scholarship. Prior to returning to graduate school Dana served as the Public Programs Coordinator at the Field Museum from 2007-2009 and as a Certified Nursing Assistant from 2010-2011. She is currently the head of a very active girl scout troop.

Melissa Heim receiver her B.A. from Vanderbilt University as a double major in Medicine, Health, and Society and Latin American Studies, with minors in Economics and Spanish. She is currently studying for her Masters in Public Health at UIC in the Department of Community Health Sciences with a concentration in Maternal and Child Health where she has maintained a 4.0 GPA. As an undergraduate at Vanderbilt Melissa served as a Fellow/Americorp Intern for the Vanderbilt Center for Health Services where she directed after-school nutrition and obesity prevention programs for elementary school students over 3-years.

Melissa Taylor received her B.S. in Exercise Science from Appalachian State University in 2011. She is currently completing her graduate studies at UIC where she is studying for an M.S. in Kinesiology with a concentration in Applied Exercise Physiology. During undergraduate Melissa interned for Velocity Sports Performance where she served as a strength and conditioning coach for 75 primary and secondary school students.

Adrienne Farrell is currently studying for her M.S. in Kinesiology with a concentration in Applied Exercise Physiology at UIC. Prior to returning to graduate school, Adrienne worked as a Special Education teacher for primary school students for 7 years.

Tristesse Jones received her B.S. in Crop Sciences in 2010 from the University of Illinois at Urbana-Champaign. She is currently studying for her PhD in Pharmocognosy at UIC where she investigates creating medicines out of plants from the Midwest. Tristesse was born and raised in Chicago's Austin neighborhood and has served as a dance instructor at her church for the past three years.

Undergraduate Assistant Instructors:

Ikemsinachi Ukeka is a Junior in Kinesiology and Pre-Medicine at UIC where he is a member of the Honors College. After graduating Ike wants to go to Medical School to become a Pediatrician.

Rachel Volkl is a Junior Kinesiology major at UIC where he is a member of the Honors College. Outside of her studies Rachel volunteers as a softball coach in Pilsen and as a peer tutor at UIC.

Michelle Miller is a Junior Kinesiology major at UIC where she is an active member of the Kinesiology Club. Michelle works as a nanny and tutor outside of her studies and spearheaded an academic supplies drive at UIC, which has provided us with an abundance of books and activities for the after-school program.

Paulius Smulkys is a Senior Psychology major at UIC. He received his Associate's degree in Psychology from Morain Valley Community College in 2010. Paulius intends to be a psychologist and has an interest in working with children with ADHD.

Paul Pulpalaan is a Senior Kinesiology major at UIC. He received his Associate's degree from Joliet Community College where he worked as an after-school instructor for primary school children. In his spare time Paul works as a freelance photographer.

Seena Mathew is a Junior Kinesiology major at UIC. Seena is interested in becoming a Child Psychologist and has substantive experience working as a mentor, tutor, babysitter, and Sunday school teacher for elementary-aged children.

Jennifer Quijada is a Senior Kinesiology major at UIC. Jennifer is the President of Lambda Theta Alpha Latin Sorority Inc. where she coordinates a partnership between the sorority and St. Jude's Children's Hospital.

Graduate and Undergraduate Data Collectors:

Nefertiti Oji Njideka-Hemphill received her BA in Biology from Denison University in 2005. She is currently studying for her M.S. and R.D. in Nutrition from UIC. Prior to coming to UIC, Nefertiti worked as a research assistant in a genetics lab at The Ohio State University.

Elizabeth Adetoro received her BS in Food Science and Human Nutrition from the University of Illinois at Urbana-Champaign in 2010. She is currently pursuing her MPH in the Department of Community Health Sciences with a concentration in Health Policy and Administration. She has extensive experience with community-based research.

Rosa Patino received her BA in Psychology from Duke University in 2012 where she worked for 2-years as a Data Technician at the Duke University Medical Center. She currently works as a research assistant in the UIC Department of Kinesiology and Nutrition Exercise Psychology Laboratory.

Carlos Martinez received his BA in Psychology from the University of Illinois at Chicago in 2011 where he served as an undergraduate research assistant for multiple studies across the Departments of Kinesiology and Nutrition and Educational Psychology. Carlos hopes to pursue a Master's Degree in Organizational Psychology.

Alexander Ayala received his BA in Psychology from the University of Illinois at Chicago in 2012, since graduating Alex has worked as a research assistant for the Institute for Juvenile Research. He hopes to pursue graduate school in School or Child Psychology in the coming years and has interest in working with children with ADHD.

Zanaib Ademide Williams is a Senior BA student in Nursing at the University of Illinois at Chicago where she aspires to be a pediatric nurse.

B. Appendix B
CPS RRB Approval

Office of Strategy, Research & Accountability
125 South Clark Street, 16th Floor, Chicago, Illinois 60603
Telephone: (773) 553-5347
Fax: (773) 553-2436

August 17, 2012

Eduardo Bustamante
University of Illinois at Chicago
1919 W. Taylor Street
Room #611, MC 994
Chicago, IL 60612

Dear Mr. Bustamante,

Thank you for your interest in conducting research in The Chicago Public Schools. The Research Review Board of the Office of Strategy, Research & Accountability has reviewed your proposal and has approved your request to conduct research. Although your study has been approved, school principals have final authority over activities that are allowed to take place in the school. If data collection continues beyond a year from this approval, please complete the Modification & Continuing Review Process Checklist.

Upon completion of the research study, a copy of the final report or summary of the results must be provided to the Research Review Board. The Board reserves the right to use the information in the research report or summary for planning, solicitation of grants, and staff development.

Please note that your study has been assigned Project ID # 697. If you have any questions, please contact me directly at 773-553-5347.

Sincerely,

Stacy Norris
Chair, Research Review Board
Office of Strategy, Research & Accountability

C. Appendix C
UIC IRB Approval

UNIVERSITY OF ILLINOIS
AT CHICAGO

Office for the Protection of Research Subjects (OPRS)
Office of the Vice Chancellor for Research (MC 672)
203 Administrative Office Building
1737 West Polk Street
Chicago, Illinois 60612-7227

Approval Notice
Initial Review (Response to Modifications)

August 18, 2011

Eduardo Bustamante, BS
Department of Kinesiology and Nutrition
1919 W Taylor St., Room 615
M/C 994
Chicago, IL 60612
Phone: (312) 413-0087 / Fax: (312) 413-0319

RE: Protocol # 2011-0555
"Project Play"

Please be sure to add "to be determined" key research personnel to this study via an Amendment. Please be sure that the updated Appendix P and documentation of training are accompanied by an Amendment Form when submitted to the UIC IRB.

Please note that a copy of the research approval from the Chicago Public Schools (CPS) Research Review Committee is required to the submitted to the UIC IRB for approval prior to recruiting/enrolling subjects or collecting data from CPS records. CPS approval must be accompanied by an Amendment Form when submitted to the UIC IRB.

Please submit a letter of support from each of the school sites listed on Appendix K via an Amendment. Please note that letters of support must be accompanied by an Amendment Form when submitted to the UIC IRB.

Dear Mr. Bustamante:

Your Initial Review (Response to Modifications) was reviewed and approved by the Expedited review process on August 16, 2011. You may now begin your research

Please note the following information about your approved research protocol:

Protocol Approval Period: August 16, 2011 - August 14, 2012
Approved Subject Enrollment #: 170
Additional Determinations for Research Involving Minors: These determinations have not been made for this study since it has not been approved for enrollment of minors.
Performance Sites: UIC
Sponsor: National Institute of Mental Health
PAF#: 2011-03148
Grant/Contract No: RMH093152A
Grant/Contract Title: Physical Activity Intervention for ADHD and DBD
Research Protocol(s):

a) Project Play, Research Protocol; Version 2; 08/11/2011

Recruitment Material(s):

a) Teacher Meeting Recruitment Script; Version 1; 08/11/2011

b) Teacher Meeting Handout; Version 1; 08/11/2011

c) Teacher Introduction and Screening; Version 2; 08/11/2011

d) Parent Introduction and Screening; Version 2; 08/11/2011

e) Parental Notification from School Form; Version 1; 08/11/2011

f) Systematic Screening for Behavior Disorders (SSBD)

Informed Consent(s):

a) Teacher Consent; Version 2; 08/11/2011

b) Waiver of Informed Consent granted under 45 CFR 46.116(d) for the schools administrators to call the parents to see if they are interested in participating in the study

c) Alteration of Informed Consent granted for the eligibility screening

d) Waiver of Signed Consent Document granted under 45 CFR 46.117 for the eligibility screening

Assent(s):

a) Child Assent; Version 1; 08/06/2011

Parental Permission(s):

a) Parent Consent and Permission; Version 2; 08/06/2011

Your research meets the criteria for expedited review as defined in 45 CFR 46.110(b)(1) under the following specific categories:
(5) Research involving materials (data, documents, records, or specimens) that have been collected, or will be collected solely for nonresearch purposes (such as medical treatment or diagnosis).
(6) Collection of data from voice, video, digital, or image recordings made for research purposes. (7) Research on individual or group characteristics or behavior (including but not limited to research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Please note the Review History of this submission:

Receipt Date	Submission Type	Review Process	Review Date	Review Action
07/07/2011	Initial Review	Expedited	07/14/2011	Modifications Required
08/12/2011	Response to Modifications	Expedited	08/16/2011	Approved

Please remember to:

→ Use your **research protocol number** (2011-0555) on any documents or correspondence with the IRB concerning your research protocol.

→ Review and comply with all requirements on the enclosure,
"**UIC Investigator Responsibilities, Protection of Human Research Subjects**"

Please note that the UIC IRB has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

Please be aware that if the scope of work in the grant/project changes, the protocol must be amended and approved by the UIC IRB before the initiation of the change.

We wish you the best as you conduct your research. If you have any questions or need further help, please contact OPRS at (312) 996-1711 or me at (312) 996-9299. Please send any correspondence about this protocol to OPRS at 203 AOB, M/C 672.

Sincerely,

Marissa Benni, M.S.

IRB Coordinator, IRB # 2
Office for the Protection of Research Subjects

Enclosure(s):
1. **UIC Investigator Responsibilities, Protection of Human Research Subjects**
2. **Informed Consent Document(s):**
a) Teacher Consent; Version 2; 08/11/2011
3. **Assent Document(s):**
a) Child Assent; Version 1; 08/06/2011
4. **Parental Permission(s):**
a) Parent Consent and Permission; Version 2; 08/06/2011
5. **Recruiting Material(s):**
a) Teacher Meeting Recruitment Script; Version 1; 08/11/2011
b) Teacher Meeting Handout; Version 1; 08/11/2011
c) Teacher Introduction and Screening; Version 2; 08/11/2011
d) Parent Introduction and Screening; Version 2; 08/11/2011
e) Parental Notification from School Form; Version 1; 08/11/2011

f) Systematic Screening for Behavior Disorders (SSBD)

cc: Charles B. Walter, Department of Kinesiology and Nutrition, M/C 517
David Xavier Marquez, Department of Kinesiology and Nutrition, M/C 994
OVCR Administration, M/C 672

D. Appendix D

Dissertation Committee Members and Consultants

Sponsors:

Stacy L. Frazier, PhD, will be the primary sponsor for Mr. Eduardo Bustamante. Dr. Frazier is currently an Associate Professor in the Clinical Science Program in Child and Adolescent Psychology at Florida International University. Dr. Frazier was a Research Assistant Professor of Psychology at the Institute for Juvenile Research in the Department of Psychiatry, College of Medicine at the University of Illinois at Chicago from 2001-2011. As noted in her letter of support, Dr. Frazier received her Ph.D. in Clinical Science in 2000 from the Indiana University Department of Psychology, and an A.M. in Public Policy in 1999 from The Irving B. Harris School of Public Policy Studies at The University of Chicago. Her research examines accessible, effective, and sustainable community-based models of mental health service delivery for children and families living in urban poverty. She is Principal Investigator on an NIMH-funded R01 grant examining associations among social context, service quality and children's outcomes in after-school programs. This study extends a program of research and collaboration with the Chicago Park District focused on building a service model for mental health promotion during out-of-school time. Dr. Frazier is also Co-Investigator on an NIMH-funded Developing Center for Innovation in Intervention and Services Research Grant P20 MH078458 (PI: Atkins) through which she directs a study examining associations among teacher and student reports of climate, classroom practices, and student outcomes. This study extends a program of research focused on building a model for school mental health services that is guided by empirical evidence for schooling as critical for children's social and emotional adjustment, and by evidence for the direct and indirect benefits of academic achievement for children's mental health. Dr. Frazier has ten years of experience with children's mental health services research studies in high poverty communities in Chicago. Her studies reflect the overall goal of her work to develop new models of community mental health practice focused on supporting the mission, improving the quality, and enhancing the capacity of neighborhood settings to promote mental health and adaptive functioning for children living in urban poverty. Dr. Frazier has supervised three post-doctoral trainees and one medical student who was the recipient of a diversity supplement to her NIMH-funded R34 grant (MH-070637). Through quarterly visits to Chicago, weekly phone meetings with Mr. Bustamante, and additional, regular email correspondence, Dr. Frazier's support will be instrumental in facilitating the ongoing relationship with the staff and leadership team at Emmet Elementary, creating an individualized behavior plan for each student, overseeing implementation of the Good Behavior Game, recruitment of staff, design of fidelity measures, the performance of outcome measures related to child behavior and academic performance, and training in the responsible conduct of research. Mr. Bustamante has been working with Dr. Frazier and her investigative team since September, 2008.

David X. Marquez, PhD, will supervise Mr. Bustamante's dissertation research project as co-sponsor. He will continue to have daily interaction with Mr. Bustamante and will be available for weekly supervision and ongoing support related to implementation of the proposed work. Dr. Marquez earned his Bachelor of Science degree in Psychology from Loyola University Chicago and his Masters and Doctoral degrees in Kinesiology from the University of Illinois at Urbana-Champaign where he co-authored some of the seminal studies demonstrating the cognitive benefits of exercise. Dr. Marquez' area of specialization is in Exercise Psychology/Behavioral Medicine, where he has assisted on several

federally-funded, interdisciplinary, randomized controlled trials examining the cognitive, physical, and functional changes in older adults resulting from physical activity interventions. His research agenda focuses on health disparities in physical activity and disease/disability among Latinos. His research utilizes a social cognitive framework and includes study of the physical activity levels of Latinos and the physical, cultural, environmental, and psychological determinants and outcomes of physical activity of Latinos. He uses randomized controlled trials and community-based interventions towards the prevention of disability and the maintenance of cognitive functioning and quality of life in older Latino adults. Dr. Marquez has significant experience and expertise in the measurement and evaluation of physical activity and fitness and has served on a number of national committees to this end. Dr. Marquez' support will be instrumental in the implementation of the randomized-controlled design; the performance of outcome measures related to EF, physical fitness, and physical activity; the conduct and interpretation of focus groups; the recruitment of study staff; training in the responsible conduct of research; and execution of the dissertation proposal and defense. Dr. Marquez has served as Mr. Bustamante's graduate advisor since 2006, has known him since 2004, and has been essential in facilitating his development and the materialization of the current study.

Consultants and Collaborators:

Catherine L. Davis, PhD, will serve as Consultant and dissertation committee member for the current project. Dr. Davis has extensive experience as a Principal Investigator conducting clinical trials testing the effect of exercise on cognition in overweight or obese children (grants R01 DK70922-01, R01 DK60692-01A1, R01 HL 87923-02S1, and R01 HL 87923-01A2). She has published a number of papers on this topic. Dr. Davis will provide consultation surrounding the randomized-controlled design, performance and interpretation of the EF measures, and the implementation of the Project Play after-school program that she and her research team created. Dr. Davis and Mr. Bustamante will have monthly communications for both years of the grant through email and telephone focusing on research progress and barriers. They will also dedicate time during the annual Society of Behavioral Medicine national meeting, which Mr. Bustamante regularly attends, to discuss progress on Mr. Bustamante's work. Dr. Davis has worked with Mr. Bustamante on the current proposal since April 2009 and they have had multiple face-to-face meetings, telephone conference calls, and e-mail exchanges. Dr. Davis will dedicate her effort to Mr. Bustamante's career development without asking for monetary compensation.

Louis Fogg, PhD, will serve as a Consultant and dissertation committee member for the current project. He has written extensively in the areas of cross-cultural statistical modeling, prevention research and experimental design. He is an expert in clinical research methodology and has a twenty year history of scholarly publications. He is the current president of the Chicago Chapter of the American Statistical Association and is on faculty at the Rush Psychology Department, the Rush College of Nursing, and he is a visiting professor at the University of Illinois at Chicago. Mr. Bustamante's interactions with Dr. Fogg will include quarterly meetings during years 1 and 2 of the grant focused on analyses for the RCT. In April and May, 2013, Mr. Bustamante and Dr. Fogg will meet more frequently to conduct and interpret analyses. Dr. Fogg has worked with Mr. Bustamante on a separate grant through Rush University since September, 2008 and has been actively involved in the development of the statistical analyses proposed in the current study. Dr. Fogg will dedicate his effort to Mr. Bustamante's career development without asking for monetary compensation.

Donald R. Hellison, PhD, will serve as Collaborator and dissertation committee member for the current project. Dr. Hellison is a professor in the College of Education and co-director of the TPSR Alliance (teaching personal & social responsibility through physical activity), and a past Great Cities Institute Faculty Scholar at the University of Illinois at Chicago. Before coming to Chicago, he was professor of physical education and director of the Governor's Leadership Training program for High Risk Youth at Portland State University (OR). His honors include the National Association of Sport & Physical Education Hall of Fame Award (1999) and the International Olympic Committee President's Prize (1995). Dr. Hellison's work focuses on the development, implementation, and evaluation of alternative physical activity program models and structures that teach life skills and values, especially for underserved communities. Dr. Hellison will provide consultation regarding the implementation of the current project in an urban poor community and be a resource for the recruitment of graduate and undergraduate study staff. Dr. Hellison and Mr. Bustamante will have monthly communications through e-mail, telephone, and face-to-face meetings. Dr. Hellison has known Mr. Bustamante since 2007, during which time he has provided him with reading materials concerning physical activity programs for youth in urban poor communities. Dr. Hellison will dedicate his effort to Mr. Bustamante's career development without asking for monetary compensation.

Marc S. Atkins, PhD, will serve as a Collaborator and dissertation committee member for the current project. Dr. Atkins is a Professor of Psychology and Director of Psychology Training in the Department of Psychiatry at the University of Illinois at Chicago, and Director of Research at the Institute for Juvenile Research. Dr. Atkins and Dr. Frazier have a long-standing collaborative relationship reflected in several NIMH funded projects over the past decade. Since 1994, he has been conducting a program of NIMH-funded research examining new models for mental health service delivery in urban schools (R01-MH56491; R01-MH62629; R01-MH073749), and he currently directs a Developing Center grant (Center for the Study of Schools as a Context for Urban Children's Mental Health; NIMH P20-MH078458; PI: Atkins, Co-I: Frazier). Mr. Bustamante has participated in recruitment and data collection efforts on two of these studies. Dr. Atkins has worked closely with the central administration of the Chicago Public Schools (CPS) and the Illinois Division of Mental Health, including developing the CPS policy manual on ADHD (Atkins, Letendre, Watling-Neal, & Gamm, in press) and currently participating on a CPS task force to coordinate behavioral programming and serving on a statewide DMH evidence based practices task force. Dr. Atkins has a long-standing track record as a training director and mentor of postdoctoral fellows and early career faculty. He has been a primary mentor on four NIMH K-awards (including two currently), and has been Director of Psychology Training at the UIC Psychiatry Department for over 15 years. In 2005, the internship he developed and directs received the inaugural award for outstanding internship training by the APA Society for Clinical Child and Adolescent Psychology and recently received the APA Board of Educational Affairs 2010 award for Distinguished Contributions for the Education and Training of Child and Adolescent Mental Health Psychologists. Dr. Atkins is a fellow of the APA and APS and the recipient of a University Scholar Award from UIC for 2010-2013. Dr. Atkins will be available to ensure smooth transition of the study in light of Dr. Frazier's move to Florida International University in fall of 2011. Dr. Atkins has a long-standing relationship with Emmett Elementary School and knows the leadership team there well. As noted in his letter of support, he will be available in the event that immediate, in-person intervention is required by a mental health professional, and to assist with day-to-day management as need arises.

William E. Pelham, PhD, will serve as a Consultant for the current project. Dr. Pelham is the Director of the Center for Children and Families (CCF) at Florida International University. His area of interest is

Attention Deficit/Hyperactivity Disorder (ADHD) and Disruptive Behavior Disorders (DBD) in children and adolescents. He has studied many facets of ADHD and DBD, including: (1) the nature of cognitive deficit, (2) peer relationships, (3) diagnosis, (4) pharmacological, psychosocial, and combined treatments, (5) motivation and persistence, (6) family factors (e.g., parental alcohol problems), (7) service delivery, and (8) outcome. He has conducted much of this research through his Summer Treatment Program (STP) for children with ADHD, which has been recognized by the American Psychological Association (APA), CHADD (Children and Adults with ADHD), and SAMHSA as a model program, and is widely recognized as the state of the art in treatment for ADHD. His STP has also been employed in multiple clinical trials at the NIMH, NIDA, and SAMHSA. Dr. Pelham has authored or co-authored more than 275 professional papers dealing with ADHD and its treatment, both psychosocial and pharmacological. Dr. Pelham is a fellow of the APA and the American Psychological Society, and past President of the Society of Child Clinical and Adolescent Psychology, the International Society for Research in Child and Adolescent Psychopathology, and the Professional Group for Attention Deficit and Related Disorders. He currently serves as a member of the Council of Representatives of the APA, as well as the APA Task Force on Medication and Psychosocial Treatments for Children. He founded and directs the biennial Niagara Conference on Evidence Based Treatments for Childhood and Adolescent Mental Health Problems. He has been PI or Co-PI on more than 20 RO1 research grants from federal agencies (NIMH, NIAAA, NIDA, NINDS, NICHD, IES), and a like number from foundations and pharmaceutical companies. His laboratory is in the third percentile of all funded NIH labs in total funding over the past quarter century, and is 15th among 1600 clinical psychology laboratories in number of publications over the past 5 years. He has mentored numerous trainees to FIRST, K, and NRSA awards. He is currently funded by NIMH, NIAAA, NIDA, NINDS, IES, and industry. He has served as a consultant/advisor on ADHD and related topics to numerous federal agencies (NIMH, NIAAA, NIDA, IOM, OMAR, and the CDC), organizations (AAP, AACAP, APA, CHADD) and pharmaceutical companies (Alza, Shire, Noven, Celltech, Abbott). Dr. Pelham has published multiple papers addressing evidence-based diagnosis for ADHD and DBD and his consultation has guided the revision of the diagnostic procedure. Additionally, Dr. Pelham has offered to help supervise the execution of this effort and to be available in the case that a given diagnosis is especially challenging.

Dana Rusch, PhD received her PhD in Clinical Psychology from the University of Illinois at Chicago in 2012. Between undergraduate and gradute school Dana collaborated with researchers at Harvard University and the University of Puerto Rico towards the creation of improved mental health services for immigrant Latino families. Dr. Rusch is currently a postdoctoral fellow at the UIC Institute for Juvenile Research where she has coordinated multiple R-01 studies.

E. Appendix E

Teacher Recommendation Form

Project Play Teacher Recommendation Form, Version #2, July 11, 2012

Project Play Teacher Recommendation Form

Project Play is a collaborative research study between the University of Illinois at Chicago (UIC) and Robert Emmet Elementary School. The study will provide a daily, on-site, 12-week, adult-supervised, homework support and structured play after-school program for roughly 50-75 children in Grades 1-6 at Robert Emmet Elementary School struggling with learning and behavior.

Project Play aims to improve aspects of children's cognition, behavior, and academic performance, such as:

- Focus / Attention
- Self-Control / Hyperactivity
- On-task behavior / Working on assigned tasks
- Following directions / Listening to Teacher
- Rule-following behavior / Complying with teacher requests
- Cooperating and sharing / Displaying positive social behavior toward others
- Initiating social interaction with peers
- Playing with others, having normal rates or levels of social contact with peers
- Resolving peer conflicts in an appropriate manner
- Math and Reading

COLUMN ONE	
List Students Most Likely to Benefit from Participation in *Project Play*	
	Student Name
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

COLUMN TWO		
Rank Order Students Most Likely to Benefit from Participation in *Project Play*		
		Student Name
Most Likely to Benefit	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
Least Likely to Benefit	10	

Instructions:

1. Review the aims of Project Play listed above and then review a list of all of the students in your class.

2. In Column One, enter the names of the ten students in your classroom who you believe would benefit most from a program aiming to improve these aspects of children's functioning.

3. In Column Two, rank order the students listed in Column One according to the degree or extent to which you believe each student would benefit from improvements in these aspects of their functioning, such that the student you believe would derive the greatest benefit is listed first and so on until all ten students are rank ordered.

F. Appendix F

Daily Attendance and Ticket Logs

Project Play – Daily Attendance and Ticket Log – Arts & Crafts Group

Last Name	**First Name**	**Teacher**	**Room**	**Grade**	**Present?**	**Arts & Crafts Participation Tix** (Accuracy/Creativity, Use Supplies Correctly, Clean Up after Yourself) (0, 1, 2, or 3 [select one])	**Play Time Prize Board Tix** (0, 4, or 5)	**Homework Time Prize Board Tix** (0, 4, or 5)	**Total Tix** (0-13)
					Y / N				
					Y / N				
					Y / N				
					Y / N				
					Y / N				
					Y / N				
					Y / N				
					Y / N				
					Y / N				
					Y / N				
					Y / N				
					Y / N				
					Y / N				
					Y / N				
					Y / N				
					Y / N				
					Y / N				
					Y / N				
					Y / N				
					Y / N				
					Y / N				
					Y / N				

Project Play – Daily Attendance and Ticket Log - Physical Recreation Group

Last Name	**First Name**	**Teacher**	**Room**	**Grade**	**Present?**	**Duration** **Avg. HR** **HR High**	**Avg. HR Tix** (130-139 = 1, 140-149 = 2, 150-159 = 3, 160-169 = 4, 170-179 = 5, 180-189 = 6, 190-199 = 7, 200+ = 8)	**Play Time Prize Board Tix** (0, 4, or 5)	**Homework Time Prize Board Tix** (0, 4, or 5)	**Total Tix** (0-18)
					Y / N	Duration = ____ Avg. HR = ____ HR High = ____				
					Y / N	Duration = ____ Avg. HR = ____ HR High = ____				
					Y / N	Duration = ____ Avg. HR = ____ HR High = ____				
					Y / N	Duration = ____ Avg. HR = ____ HR High = ____				
					Y / N	Duration = ____ Avg. HR = ____ HR High = ____				
					Y / N	Duration = ____ Avg. HR = ____ HR High = ____				
					Y / N	Duration = ____ Avg. HR = ____ HR High = ____				
					Y / N	Duration = ____ Avg. HR = ____ HR High = ____				
					Y / N	Duration = ____ Avg. HR = ____ HR High = ____				
					Y / N	Duration = ____ Avg. HR = ____ HR High = ____				

G. Appendix G

Project Play Offense Contracts

Project Play 1st Offense Contract

Student Name: _____

During the after-school program on _____, I did the following:
_____
_____
_____

I received a **warning** for my behavior. Because I misbehaved, I lost the tickets I earned for this day and my play time. I know that if I misbehave again, I will receive my second offense.

If I receive a second offense, I will also lose points for that day, my parents will be notified of my misbehavior, and **my parents and I** will have to sign a 2nd Offense Contract.

I am able to make responsible decisions concerning my behavior, and I am responsible for my actions, and the consequences that follow them.

Student Signature: _____

Project Play Staff Signature: _____

Project Play 2nd Offense Contract

Student Name: _____

During the after-school program on _____, I did the following:
_____
_____
_____

I was reprimanded for my behavior. Because I have already been given a warning, this is my **second offense**. I know that I have lost the tickets that I earned for this day and my play time, and my parents will be notified of my misbehavior. In addition, **my parents and I** must sign this contract and return it on _____.

If I receive a third offense, I will also lose tickets for that day, my parents will be notified of my misbehavior, **my parents and I** will have to sign a 3rd Offense Contract, and I will be suspended for 1 day. **In addition**, **if I do not return this contract by _____, I will receive a 3rd offense.**

I am able to make responsible decisions concerning my behavior, and I am responsible for my actions, and the consequences that follow them.

Student Signature: _____

Project Play Staff Signature: _____

Parent Signature: _____

Project Play 3rd Offense Contract

Student Name: _____

During the exercise program on _____, I did the following:
_____
_____
_____

This is my **third offense**. I have been **suspended** on _____. On this day, I am not allowed to attend Project Play after school. In addition, I have lost the points that I earned for this day, and my parents will be notified of my misbehavior. **My parents and I** must sign this contract and return it on _____.

If I receive a fourth offense, I will be **suspended** for a week. I will also lose points for that day, my parents will be notified of my misbehavior, and **my parents and I** will have to sign a 4th Offense Contract. **In addition**, **if I do not return this contract by _____, I will receive a 4th offense.**

I am able to make responsible decisions concerning my behavior, and I am responsible for my actions, and the consequences that follow them.

Student Signature: _____

Project Play Staff Signature: _____

Parent Signature: _____

Project Play 4th Offense Contract

Student Name: _____

During the exercise program on _____, I did the following:
_____
_____
_____

This is my **fourth offense**. I have been **suspended for the week** of _____ through _____. On these days, I am not allowed to attend Project Play after school. In addition, I have lost the points that I earned for this day, and my parents will be notified of my misbehavior.

My parents and I must sign this contract and return it on _____. If I receive a fifth offense, I will be **expelled from the after school program.** I will not be allowed to continue participation in the after school program, my parents will be notified, and **my parents and I** will have to sign a **final** 5th Offense contract. **In addition**, **if I do not return this contract by _____, I will receive a 5th offense.**

I am able to make responsible decisions concerning my behavior, and I am responsible for my actions, and the consequences that follow them.

Participant Signature: _____

"Play" Project Staff Signature: _____

Parent Signature: _____

Project Play 5th Offense Contract

Student Name: _____

During the exercise program on _____, I did the following:
_____
_____
_____

This is my **fifth offense**. I have been **expelled** from the project.

I am no longer allowed to attend the Project Play after school program. My parents will be notified as of today, and my expulsion begins on _____.

My parents and I must sign this contract. Though I will not be attending the after school program any longer, I am still invited for post-testing. If I complete post-testing, I will still receive a prize for my time.

I am able to make responsible decisions concerning my behavior, and I am responsible for my actions, and the consequences that follow them.

Student Signature: _____

Project Play Staff Signature: _____

Parent Signature: _____

H. Appendix H

Focus Group Moderator Debrief Transcripts

Parent Focus Group Debriefing Transcript

S: Alright, so, for their personal views of the Austin community…

R: The main thing that I think they addressed was that they didn't have a problem so much with the community, more of the people within the community; and they said that the community was basically what the people made it; is what I got.

S: yeah, I got the same thing too. Like overall they liked it, but it doesn't really matter because, if you are low income it doesn't matter the community that you're in, you're gonna have the same problems, because, you're low income basically and all the problems that being low SES. Um…they didn't think that…, um, the community, the Austin community didn't really provide too much support for families; did you feel that way?

R: I um…they didn't say for families; one of the parents said that the Austin and Garfield communities,

S: were the best…

R: …were the best communities for helping them, their kids, do something, but I don't think they ever addressed...

S: The family…

R: Support for the family.

S: Uh huh

S: Um…regarding their experience with after school programs, it seems like, some of the parents talked about how, maybe the principal chooses like who gets to be in the program, so it's not really for everyone.

R: Yeah, that they're pretty selective

S: yeah, yeah. They are not very (*Inaudible ~1:40).* So….anything else for views of Austin community?

R: Not that I can think of.

S: Ok. Um, views of Emmett? (ha ha)…; that was a heated discussion (ha ha)

R: Yes. The parents felt very strongly about Emmett Elementary…and, in a negative way. They weren't…they said there was… probably most of them would agree that there weren't any good teachers, if at all at the school. Um, they also didn't seem satisfy with the administration, but one parent

did point out that, the principal did at one point, few months ago, address an issue, um, with the bandanas in the correct way; so as to keep those problems separate from the school. When the kids were coming to school with bandanas and representing the four-corner-hustlers, so…

S: Um…what else? I mean I think they don't want the school to close, because they don't want to send their kids, I don't know if they know where they want to send their kids; but at the same time, they kinda understand why it's closing… but then one the parents talked about how they…parents in general don't voice their concerns about the schools, so they are not at the meetings, so since they're not at the meetings, that why change is not coming about, because…they're not attending.

R: and they also didn't seem like they were all on the same page. Like some of them thought, you know…I guess through word-of-mouth that they're closing because they're low performance, but then they were corrected by other parents, which it was underutilization and also, you know, not coming to support her down town, because she felt very strongly about, you know, the problems that we are speaking about today…

S: mm hmm

R: they're great, but she was, kind of, you know, looking for that, every month, once a month at every meeting.

S: Right, mm hmm

S: Um… I think these are the main things that stand out from that conversation. Um…personal experience with Project Play? Um…I think they liked that they were able to meet…that they were able to socialize with other kids. Um…they liked the staff; the diversity of the staff, they really liked that.

R: They just wanted more

S: Right. They just felt they needed more…um, they didn't like the mixture of grades. Well that was also like, there was a mixture of opinions too, but like they didn't like that it was like k through

S&R: 6th...right

S: Um…what' else…some parents felt that they're…um...it helped their kids in spelling, math…

R: reading.

S: Reading…um, other parents felt that their behavior didn't change at all

R: Yea…one parent though, noticed that, basically, I think she was talking about this week, but her kids would, before Project Play, would, you know, retaliate with his brother right away, but yesterday or the day before he um basically used like, um, I don't know, um a technique that he may have, or may not have learned from Project Play and basically didn't retaliate and just started rocking back and forth; and the mother you know had never seen that before…

S: um hmm

R: and then you know, he just went about his way and did a puzzle and didn't do anything to his brother who was also in the program, so, she was pretty happy, you know, that he gained, possibly gained that from Project Play.

S: And I think another Parent reported something similar, where her daughter would typically retaliate, but this time started putting on her headphone and dancing …

R: Yeah

S: cause that was her way of like, calming down. Um…

R: and I got the feeling that they feel like if it weren't for Project Play they would have, you know, it would have been unlikely for them to have learned a coping skill

S: Yea, I think a lot of parents agreed that Project Play taught them coping skills

R: in one way or another

S: yea, right. Um…what else….

R: um, they like that it kept them off the streets.

S: Right.

R: Some of them, I think one of them addressed that they went to bed earlier

S: cause they had so many activities, so…

R: and they liked the good news notes, the star of the day, and they also liked, um, having tickets, so they had like something to show for their behavior..

S: uh huh

R: and coming home and telling their parents about it, and talking about it.

S: um…and it also provided the parent with additional time for themselves, so they kinda felt like, I don't know, maybe they had more time to pick them up later from school, they had to rely less on other parents to pick their kids up like at 3:15, so that, maybe that took a little bit of pressure off the parents a little bit too. Um…

R: and the one thing that, um, they did mention, was they would like for the program to be longer than what it was.

S: Yeah, they felt like 3:15 to 6pm

S&R: …was good…yeah.

S: They wanted it to be all year round

R: Yes (ha ha)

S: and summer (ha ha). They felt like maybe some of the staff should still be stern but at the same time give their kids like the benefit of the doubt or like second opportunities, not just kick them out immediately if they misbehaved. So maybe talking t them through like whatever they were going through.

R: mm hmm...and…

S: …that day

R: I feel like I got the impression that they feel we may have, even though we didn't ask, it may have helped to have more staff to make this easier, you know, something, if, one of the parents voiced very strongly several times that if, you know, it was good BUT, he was being bullied by the second grader, and she just couldn't let that go, and I understand, um, but I feel like, you know, she may have; I don't know if she was the same parent the addressed that, you know, more staff. I believe she was the same parent, so…

S: I think, I think it was a different parent.

R: a different parent?

S: yea, I think it was…

S&R: one other parent, yea

S: but they, overall, they agreed that the program needed more staff

R: yes.

S: mm hmm

R: and if parents could volunteer, possible

S: Right, umm hmm. And then, um…I think something else that was interesting was that one woman felt like…

R: the research study…

S: it WAS like as research study…

R: that we were just, she… I think what I remembered from her for the most part, trying to poke her, is you know, she felt like we were just jutting things down about them and, you know, basically it was just a way for us to say how blacks kids are in the community,

S: or how black kids react in like a certain environment

S&R: Yeah

S: mm hmm

R: that's what she said, and I think she may have, may think that, you know, misinformed; and I think you corrected her that we're trying to show that they ARE bad when in fact we are trying to show that physical activity will help them direct they behavior in a proper manner.

S: mm hmm

R: and I think you did a good job of telling her, or trying to tell her that

S: mm hmm

R: you know, that's not what we were doing, that was not the purpose

S: Right. Yeah I mean I think…and the recommended changes like we said were more staff, they liked the…lot of different activities, longer program, same hours…um…I think that was about it. The only other thing was….Any other ideas that stick out?

R: The only thing was, um, I think that a lot of parents mentioned, you know, at one point or another, that their kid was being picked on and just kind of…that it wasn't fair the way that they handled it. Um…

S: or that it wasn't even addressed.

R: or it wasn't addressed…

S: mm hmm

R: and they…I feel like, you know, um… that they were not satisfied with that

S: Yea. I almost felt like it was the same kid picking at (ha ha)…

R: yes

S: (ha ha) their kid…I don't know. Um…I think that's it right? Anything else that stood out? I mean, I think overall they liked Project Play, they liked that it keeps their kids off the street, because like once they go home they don't have anything to do really

R: mm hmm…

S: um…provides a safe environment; but of course, there…. One woman mentioned that she was like "some parents can be apprehensive about after school programs just because of all, like, sexual abuse…

R: Yeah

S: …"going on."

R: And I think the one main point before we finish, was, you know, we have all these kids, and some of them, we also had good had good kids in the program to begin with, and it was actually detrimental to those kids

S& R: right

S: cause they were influenced by…

R: uh huh

S: the negative behavior in the program or whatever

R: and other kids felt like they, um, possibly, you know, they had to deal with them at school and then they had to come to Project Play and also deal with them and their way of venting was, you know, what they did; whether hit or push, whatever they…

S: Right. Okay. That's it…from S & R

Child Focus Group Debriefing Transcripts

C: So, I'm just gonna go through everything that happened; just generally what I was hearing from everybody

A: Ok

C: First off with the Austin community..

A: mm hmm

C: a bunch of the kids were saying how there was gangs, a bunch of gangs kinda harassing them, people selling drugs, abandoned buildings, and they also said that there's good places, but there's also just more bad places

A: Yeah

C: and a lot of the kids were also saying that they don't really live in the Austin community, I guess they just go to school here.

A: hmm

C: and a…someone came up with the….a bunch of kids were coming up with example that ah…just last week some teenager got shot and he was just coming out of school

A: Yeah

C: they were mentioning that there's a lot of rape going on

A: mm hmm

C: There's people in the hoods kinda just taking things from them, there's a lot of profanity going on, uh, there's also stockers following some of these kids home, or just kinda harassing them

D: That was really surprising

C: yeah

A: I think like two girls said it

C: Yeah

A: it was more than one girl

C: Yeah

D: Really?!

C: and they were young girls. They were young girls

A: you know, its craziness

C: And a…they also mentioned that kids from Duke Ellington and Dupree, ah, jumped the fences

A: yeah

C: and come to pick fights. Come to pick fights with kids.

A: Yeah. While they're in recess, and like just, you know any old bum on the street, like what they were…you know the two guys, remember like….remember? I think one of them said that there was a crack-head that would come in the school and just bother them

C: yeah...yeah, a...

A: steal their winter coats and stuff, and then, I don't know, just…like really shady guys harassing the school kids too; that's what they said. One thing though, I think one of the things that _____ said, was that like, ah, he thinks that, you know, if we would all…if everybody in Austin would just come together and work together like, it would be a much better place. He said, but it was pretty loud, it caught my attention

C: Yeah. I mean, I think a couple of kids heard it and I think they kinda felt the same, but it's kinda like…they were all just kinda thinking like, man you know, like it's just an idea, they don't realize that they, that they can do it themselves; like help each other out

A: Yeah

C: you know, we don't have to fight with each other, we can just like, I think it like sounded like something that was almost impossible…

A: Yeah.

C: when it came out of their mouth. Um, and there was also….so and as far as the school, they said that there's always kids stealing things; a lot of kinds said that they were getting falsely blamed for things that uh, that they didn't do

A: yeah, a lot of them said that too...um

C: That there were a bunch of food fights all the time, and uh, people damaging cars, specifically _____ and uh, um…

A: I think one of the other teaches, _____ I think

C: Yeah _____

D: Yeah, when (*inaudible*) I heard something about _____ car

A: Yes, so…

C: And then they also said how the school's broke down,

A: yeah, like the lights don't work, you know

C: uh huh…

A: like a bunch of stuff…

C: and there's cockroaches in here, and…

A: that too…

C: so I guess things just really feel, felt like the school is not being cared of, and, a lot of them kinda had that, that sense like they knew about the school closing and they kinda, to them, I guess it sounded like they weren't surprised

A: yeah

C: or really even cared; cause they were like, you know, it's happening, we really can't do anything about it

A: I really didn't even sense that much like uh, attachment, uh like…

D: to the school.

A: to the school, yeah. Like they complained about, not just the school but like the kids too, you know? Like, it seems like almost everybody has somebody that bothers them you know, like somebody has a grub with somebody

C: yeah, that's the thing is though, a lot of those might have been like, just kids kinda taking one situation and like blowing it up into…(*inaudible ~3:54*)

A: yeah, yeah

…

C: yeah. And those teachers since I was observing them, I mean, the teachers they liked actually I feel like they're really good at like, you know, being nice, but at the same time being really assertive when they have too, Cause you know, obviously these kids can get difficult, but I feel like they, like those teachers were really well-rounded.

A: Yeah

C: like they were, they would be really disciplinary when they needed to, and like kinda lenient when they had to also

A: mm hmm

C: they also said like, some of their teachers, you know, like really helped them learned. I think like two three kids said that from what I heard. Like you know, they teach them in a way that they can learn more stuff

A: and they like to lean

C: yeah.

A: they like to learn. It's just that, not of lot of them were learning or got the chance because of all the disruption

C: yeah, exactly

D: mm hmm

A: yep. A lot of them were complaining about the disruption in class too; with other kids

C: Another thing that happened was uh, that they also didn't really like that Emmette didn't have programs and that's something I heard from the parents too when I was interviewing them,

A: mm hmm

C: and…uh, they wanted programs that would help them, like them socialize and projects, and, just things like sports; so just anything in general to do after school.

A: right. Um…Project Play?

C: So for Project Play they said it was fun, but some kids…which, I mean, this was kinda, they were circling this idea for most of the time, that uh, it was fun but, some kids were too interruptive and talkative, so it didn't allow for everybody to enjoy the activities

A: yeah. Right.

C: and um, they, another thing that came across really big was that they enjoyed playing with the bigger kids, and just even the adults, the staff members.

A: yeah, they really liked the staff members. I think was only one or two that a few of them didn't like.

D: yeah.

A: and I think that was about it.

C: So, I mean, I'm not sure if it's because obviously the staff members aren't gonna kinda treat you with more respect than they get from their peers, but uh, it could also be like the tension. That's the thing because, a lot of these kids from what I was feeling, or getting, was that they don't feel like they get paid attention to

A: they don't get the attention that the staff give them

C: uh huh, so they enjoy that, and they really don't need that from their peers, so…that's kinda why they enjoy being with older kids. Kinda that mentorship and like

A: yeah

C: role model kinda thing, which is also, that's why like they were talking about like _____; he is like a role-model

A: exactly, like they were saying, you know, the staff helped them with their homework, you know, they helped them like solve math problems and do the activities, and they like all of that, like they like doing the homework part and the activities part

C: Yeah…so, kids were actually saying yeah, that Project Play actually helped them, so they were actually helping them with the homework during the program, and not only that, they were helping them, I guess learn and just get good grades in general, and they said, like they would kinda like see it in the classrooms, they would just be more….paid attention and things

A: right

A: um, and they also said that uh, they just enjoyed playing games in general

A&D: yeah

C: One of the things though that they said they didn't like…uh, is that, maybe, they played uh, the same games too many times. I know a couple kids said that.

D: yeah, they wanted more, like, different games

A: mm hmm…yeah they said that they were bared.

C: I think one of them said something like they would get tired of hearing the instructions for the same game over and over so they wanted better and more activities, but, uh, when we asked them, you know, obviously, they only said, what like volleyball, um…

A: dancing, girls were dancing and stuff like that…

C: I think painting…but I think they did paint; I am not sure, maybe what kinda paint…uh

D: I believe they did paint

C: I am not sure what they wanted specifically, maybe like, I'm not sure, if it was stencil….I mean I am not sure what they did in that actual group, but, uh…I'm not sure what they meant by painting.

A: yeah, uh…

C: so yeah, they said they were bored and frustrated with routines, uh…they said they enjoyed when the adults interacted with them during the activities, um, and some of them are saying how they use to be mean but now…like when you ask them if, about how they…any changes at home, they said how they use to be mean but now they're somewhat more friendly, like even towards parent and everybody in general

A: Yeah…

C: but I also heard a few kids saying they didn't experience any change at home. I know some specifics were like they don't talk back to their parents at home and stuff, or like…they're just like more um, they're more well behaved.

A: I asked them directly you know, do you feel like you are more well behaved cause of Project Play at home? And they said yeah, so, that was another thing

C: ok, um, what else? Let me see, another bad thing was they said that they didn't really like how we were keeping kids under control, or I guess our lack of keeping kids under control…

A: right, yeah

C: during the program, and that they wanted the kids…what they wanted us to make the kids respect each other. That's one thing we talked about later on, like if, when we asked, I think you asked uh, what would you uh, what would you include in your Project Play if you start from scratch? An d then they all talked about, like, yeah, respecting or if there's misbehaving, like certain like, getting kicked out, or punishment type things, like three strikes and stuff…they were really like into that so it seems like they wanted more, uh, let's see…

A: like control, discipline

C: so what I got was that, they said that the three strike rule was too lenient and they preferred something like one strike being punishable with like, three to five days out of the program.

A: Yeah

C: but at the same time, what's kinda weird about that, is that a lot of the kids who did get punished, were saying how they appreciated, how _____ let em back in and how he didn't have any negative feelings towards them specifically…

D: A lot of them really liked _____

C&A: Yeah

C: That's the thing too, is…that's the weird thing, is that they wanted the kids to get punished, but at the same time, they were being….

D: they were happy for that second chance

C: yeah, so, it was kinda hard to say what worked best.

A: mm hmm

C: um, they also…I guess they just said also, they need more punishment, um, I guess, they just really wanted a lot of the kids to, so…. I mean, for what my idea was, also I was thinking, maybe they enjoyed being in uh, like a group where everybody is the same age and there's, like uh maybe one adults telling them what to do, as oppose to everybody being all different ages, and then one kid tries to control the whole room, and then you gotta control that kid, and then

D: Yeah, cause I heard one kid talking about how, his like yeah when you try to talk to each other, little kid is like oh what are you saying? What does that mean? Bla bla, and you have to explain to them. Like he was pretty much saying that, he would have liked it, for it to be more people around his own age so they can relate to each other better , and not have to like explain things or to wait for the little kids to understand what was going on…stuff like that.

C: Yeah, cause I mean my idea….I think it would be a good idea maybe like to put em in groups of like whatever ages are around like three years apart or so,

A: Yeah

C: cause that way you could kinda get that like big brother mentor kinds thing going with the older kid and they're not too far from where the younger kid would be, as oppose to uh, you know, the 12 year old being in the room with like a 6 year old and they have nothing to relate too or don't even wanna talk to each other

A: but some of the younger kids did like uh, one of the first graders they said, you know, they liked hanging out with the fifth graders, for example. Like they, I don't know…

C: yeah that's the thing, I mean, that's why I was like thinking maybe if you fix it so they only three years next, away, they might feel more, kinda like, you know, I was there or I'm about to be there or I wanna be like him...or,

A: right.

C: Um…

A: oh one thing that they also mentioned was that didn't like just being in that one group, like they wished they could switch from Arts and Craft sometimes to PE, like another week for example and then switch back

C: Yeah. And what I took from that also was that clearly they liked both groups they just didn't want to be in that group for the who time

D: whole time, yeah.

A: Oh, another thing that I tried to squeeze in there, but it seems like they didn't want to talk about too much, was how Project Play impacted their learning, some of them actually said like they uh, are better in the classrooms with their teachers because of Project Play, you know, like they learned better; I think one girl said because they do homework in Project Play, like, it helped in the classroom

C: And that's the thing to though, is, cause when they were getting, when the staff was helping the kids with the homework, uh, I'm sure that they obviously couldn't devote their attention to that kid, and then everybody, So, uh, cause a lot of the kids were also saying that, like, generally they didn't feel like they got, sometimes didn't feel like they got enough attention from the staff,

A: Yeah,

C: but I'm assuming that's kinda what must have happen, maybe they were helping them with the homework, or trying to get them under control and then, they really didn't get to uh, give attention to the rest of the kids. So they were kinds of just doing whatever, and then, there was just a bunch of kids being disruptive I guess. Um, they… I guess yeah, last week they were just saying how they enjoyed the extra effort from _____ with the pizza party and the prizes, but they also said that they wanted; they thought that the prizes were like really uh,

A: Yeah I was just about to say that...

C: unattainable; they wanted it to be kinda easier…

D: worth less tickets

C: Yeah, less tickets.

D: and that they should give out more tickets during each day

C&A: yeah

D: so in all they just wanted to be able to get more prizes

C: I'm sure maybe it was just, they weren't really, I guess uh, kinda, showed that, you know, this accumulates, that you have to be good over a certain amount of time; they kinds just thought about it last minutes, like, oh, you know I was good for like two days

D: right, not knowing (*inaudible*)

C: they didn't realize that this was kinds like accumulative thing, so, I guess maybe going over the rules for the raffle and them knowing the prizes in advance might kinds give them an, oh you know I really want that camera…

A: like maybe just that understanding that they need to earn it.

C: Yeah, it's like more concrete, cause they'll be like oh my God I need this and if I wanna get it I'm like 20 tickets away, so I need to be good for like 5 more day minimum. So it would kinds help them get more concrete.

A: Yeah. But that's tough though when everybody's disruptive, and then there's kids bothering you and you don't retaliate. Yeah, it's tough in general, it's like a sick stomach type thing, that's what I got from it, like, I don't know, like _____ put like um, you know, like the prize thing with like getting the tickets. That was, I guess that's the thing with, just like them trying to get discipline….but at the same time it's tough because like, it's like, everybody at one point or another is disruptive or is causing trouble

C: Yeah. I feel like by them not knowing what prizes they could get, or even how many tickets they needed, they really didn't know what the tickets meant.

A: oh ok. Looks like we got a lot of…

C: yeah, I think that was pretty much it…

A: wait, wait, wait…they also said that Mr. _____ was

A&D: a role model

D: They really thought that he was a role model to them because he didn't have to do all these things or bring all these things to them or bring this program to their school and how nice he was; that they looked up to somebody whose able to be nice to people, to a kid he, it's not like it's his child, these are just kids he just met, he's able to be nice to them and give them things and provide such a great program to them. That was pretty much why they looked up to him as a role model.

A: yeah. Couple of them mentioned, the older kids I think a couple of the 5th graders said, you know, why would he come to this school? Why would he come to this broken school, but, like with these kids and like give us all these stuff and spend all his money on us, like

D: right.

A: and I asked them, then I asked them like oh, do you wanna be like that when you grow up? And some of them said yeah. I think a couple of them, like two, three of them said, yeah, you know being respectful like how _____ is respectful to us.

D: Yea

C: That's what I got from that too.

A: Yeah, so that was about it I think.

C: Yeah, that was pretty much it. They said that they enjoyed him caring and not like taking out personal anger on them.

A: and being like forgiving and welcoming them back with the pizza party and everything, even when they were bad during the program.

D: Right and he would bring them back

A: yea, he was accepting

C: yeah that was about it

A: I think that was pretty much it

C: mm hmm.

VIII. CURRICULUM VITAE

Eduardo Esteban Bustamante
University of Illinois at Chicago
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A. RESEARCH INTERESTS:

● Physical activity as a tool and space for mental health promotion, prevention, and treatment in urban poor communities.
● Physical activity intervention background with extensive service and research experience in urban Latino and African-American communities.

B. EDUCATION:

Doctor of Philosophy Summer 2013 (anticipated)
University of Illinois at Chicago
Major: Kinesiology, Nutrition, and Rehabilitation Sciences
Emphasis: Exercise and Health Psychology
Advisor: Dr. David X. Marquez
Dissertation: Physical Activity Intervention for ADHD and DBD
GPA: 3.8

Enrolled in Masters of Science/Doctor of Philosophy Program Fall 2006-Spring 2007
University of Massachusetts, Amherst
Major: Kinesiology
Emphasis: Exercise Psychology and Exercise Physiology
Advisors: Drs. David X. Marquez and Patty S. Freedson
GPA: 3.9

Bachelor of Science
Spring 2006
University of Massachusetts, Amherst
Major: Kinesiology
Commonwealth College, *Cum Laude*
GPA: 3.3

C. RESEARCH EXPERIENCE:

C1. Principal Investigator

Physical Activity Intervention for ADHD and DBD (R36MH093152-01A1, PI: Eduardo E. Bustamante; Primary Sponsor: Dr. Stacy L. Frazier, UIC Department of Psychiatry, Institute for Juvenile Research [IJR]; Co-Sponsor: Dr. David X. Marquez, UIC Department of Kinesiology and Nutrition, Exercise Psychology Laboratory [EPL])
● 2011-2013
● Designed and conducted a pilot randomized-controlled trial investigating the impact of a 12-week after-school physical activity intervention on the cognitive, behavioral, and academic functioning of children with Attention Deficit Hyperactivity Disorder (ADHD) and Disruptive Behavior Disorders (DBD) residing in Chicago's Austin Community.

Learned Industriousness in the Physical Activity Domain (UIC Department of Kinesiology and Nutrition Funding, PI: Eduardo E. Bustamante)
● 2008-2010
● Designed and conducted a lab-based experiment which enrolled 80 undergraduate students. The study tested the hypothesis that physical activity can instill industriousness through the pairing of the sensation of physical effort with reinforcers.

C2. Graduate Research Assistant
Bypassing Alzheimer's: Improving Latinos' Activity and Cognition (BAILA-C) (Alzheimer's Association: New Investigator Research Grant to Increase Diversity, PI: Dr. David X. Marquez)
● 2011-2013
● Assisted with participant recruitment and collection of physical, cognitive, and psychological measures for a 4-month randomized-controlled trial testing the impact of the revised BAILAMOS© program on quality-of-life, lifestyle physical activity, and physical and cognitive function of older Latino adults.

Boosting Activity in Latino Elderly (BAILE) (Midwest Roybal Center for Health Promotion and Translation Research Grant, PI: Dr. David X. Marquez)
● 2011-2012
● Assisted with participant recruitment and collection of physical activity, cardiovascular health, and neurocognitive measures for a pilot single group trial to test the feasibility and impact of the revised 4-month BAILAMOS© program on cardiovascular health in sedentary older Latinos who are overweight/obese.

Leaders @ Play (Charles E. Marks Jr. Charitable Trust Research Grant, PI: Dr. Stacy L. Frazier)
● 2011-2012
● Assisted with program design for a pilot Chicago Park District (CPD) after-school program for adolescents. The program paired a mental health professional (Social Worker) with a CPD Recreational Leader to explicitly teach problem solving, emotional regulation, and effective communication through recreation. Adolescents completing the program were eligible to work as CPD Junior Counselors the following summer.

Project NAFASI (Nurturing All Families through After School Improvement) (R01MH081049, PI: Dr. Stacy L. Frazier)
● 2009-2012

● Assisted with site and participant recruitment, data collection and coordination, after-school observations, data analysis, data entry, and manuscript writing for a cross-sectional study aimed at developing a service model to support Chicago Park District after-school staff in meeting the mental health needs of participating youth.

Project WEL (Walking & Environment in older Latinos) (Midwest Roybal Center for Health Promotion and Translation Research Grant, PI: Dr. David X. Marquez)
● 2010-2011
● Assisted with implementation, analysis, and abstract/manuscript preparation of focus groups, key informant interviews, and a quantitative environmental audit of community and street-scale factors associated with physical activity among older Latino adults with mobility limitations living in the South Chicago community.

Balance & Activity In Latinos: Addressing Mobility in Older adultS (BAILAMOS) (Departmental funding, PI: Dr. David X. Marquez)
● 2010
● Assisted with recruitment, implementation, and abstract/manuscript preparation for a single group pilot examining the feasibility and impact of the BAILAMOS Latin dance intervention for older Latino adults living in South Chicago.

Cognition and Physical Activity among Community Elderly Study (CAPACES) (Rush University Medical Center Pilot Projects, PI: Dr. JoEllen Wilbur, Rush University College of Nursing; Co-I: Dr. David X. Marquez)
● 2008-2010
● Assisted with site and participant recruitment, screening, data collection, data entry, data analysis, and manuscript writing for a cross-sectional study examining the associations between objectively and subjectively-measured physical activity and health in older Latino adults.

Links to Learning (R01MH073749, PI: Dr. Marc S. Atkins, UIC Department of Psychiatry, IJR; Co-I: Dr. Stacy L. Frazier)
● 2008- 2009
● Assisted with recruitment, data collection, and classroom observations for a cluster randomized-controlled trial aimed at developing a service model linking primary school classrooms with mental health providers in order to support school teachers and staff in meeting the mental health needs of children living in urban poor communities.

Development of Intervention Strategies to Reduce Risk of Gestational Diabetes Mellitus among Latina Women (National Institute of Health [NIH] Research Supplement to Promote Diversity in Health Related Research, PI: Dr. David X. Marquez; Parent Grant & PI: "Epidemiology of Stress and GDM Among Latina Women" [R01DK64902-01], Dr. Lisa Chasan-Taber, UMass, Amherst, School of Public Health)
● 2006-2007
● Assisted with recruitment, implementation, analysis, and manuscript preparation for a series of focus groups assessing barriers and facilitators to physical activity among sedentary pregnant Latina women at risk for gestational diabetes mellitus.

ABC Study: Activity, Barriers, and Correlates of Dementia Caregivers and Non-caregivers (Healy Faculty Research Grant, UMass, Amherst, PI: Dr. David X. Marquez)
● 2006
● Assisted with subject recruitment and screening, data collection, and data entry for a cross-sectional study to identify the barriers and facilitators to physical activity perceived by caregivers.

C3. Undergraduate Research Assistant

Validity of the Omron HJ-112 pedometer during treadmill walking (Funding from Omron, Inc., PI: Dr. Patty S. Freedson, UMass, Amherst, Department of Kinesiology, Exercise Physiology Laboratory)
● 2005
● Assisted in subject recruitment, preparation of equipment, and data collection for a study to design a more accurate energy expenditure prediction equation for OMRON pedometers.

Effects of Glucosamine Supplementation on Exercise-Induced Muscle Damage and Adaptation (PI: Dr. Priscilla M. Clarkson, UMass, Amherst. Department of Kinesiology, Muscle Biology and Imaging Laboratory)
● 2005
● Assisted in subject recruitment and data collection for a randomized controlled trial examining the effects of glucosamine supplementation on muscle soreness.

D. TEACHING EXPERIENCE:

Instructor: KN 335 – Exercise Psychology (UIC Department of Kinesiology and Nutrition)
● 2008–2009
● Designed and implemented course materials (i.e., tests, quizzes, reading list, lecture slides, and group projects) for a required 3-credit undergraduate lecture course. Course content focused on the psychological antecedents and consequences of physical activity with special attention given to health behavior theory and approaches to physical activity intervention. Course enrolled 75 students per semester for two semesters.

Instructor: KN 297D - Anatomy and Physiology II Lab (UMass, Amherst Department of Kinesiology)
● 2006- 2007
● Designed and implemented course materials (i.e., lecture slides) for a required undergraduate 1-credit laboratory course. The course utilized an interactive virtual laboratory covering endocrine, digestive, cardiovascular, and respiratory systems (Physio Ex 6.0 Laboratory Simulations in Physiology for A & P). Course enrolled 30 students per semester for two semesters.

E. GRANTS AND FELLOWSHIPS AWARDED:

Illinois Early Childhood Activity Program (ICAP) Graduate Travel Fellowship

● 2013
● Provided funding to attend the ICAP Conference in March, 2013.

National Institute of Mental Health (NIMH) Dissertation Research Grant to Increase Diversity (R36MH093152-01A1, PI: Eduardo E. Bustamante, Primary Sponsor: Dr. Stacy L. Frazier, Co-Sponsor: Dr. David X. Marquez).
● 2011-2013
● Provided two years of funding for graduate studies and $15,000 per year for execution of a pilot randomized controlled trial entitled, "Physical Activity Intervention for ADHD and DBD" ($78,093, Impact/Priority Score: 10).

University of Illinois at Chicago College of Applied Health Sciences Minority Leadership Program
● 2010-2011
● Provided two years of funding for PhD students, aimed at increasing rates of racial/ethnic minority doctoral students in the college.

University of Massachusetts, Amherst Graduate College National Science Foundation (NSF) Northeast Alliance Fellowship
● 2006-2007
● Fellowship provides funding for first year of Master's studies, aimed at increasing rates of underrepresented racial/ethnic minority students receiving PhD's in the STEM (Science, Technology, Engineering, and Math) sciences towards achieving excellence in college and university teaching.

F. AWARDS AND HONORS:

University of Illinois at Chicago (UIC)
UIC Graduate Student Council (GSC) Travel Award ($300) 2011, 2012

American College of Sports Medicine (ACSM)
Leadership and Diversity Training Program, Level 2 2010-2013

University of Massachusetts, Amherst
Exercise Physiology Laboratory Outstanding Undergraduate Research Assistant 2006
Leadership Award, Bilingual Collegiate Program (BCP) 2005

G. COMMUNITY & PROFESSIONAL SERVICE:

Ad-Hoc Reviewer
Journal of Mental Health and Physical Activity (MENPA) 2012-2013
Journal of Immigrant and Minority Health (JOIH) 2013

University of Illinois at Chicago (UIC)
Search Committee, Visiting Research Specialist 2012
College of Applied Health Sciences Diversity Committee, Student Rep. 2012-Present

Graduate Student Council (GSC), Departmental Representative	2009-2012
College of Applied Health Sciences Diversity Strategic Planning Steering Committee, Student Representative	2011-2012

American College of Sports Medicine (ACSM)

Ad Hoc Committee on Diversity Action, Student Representative	2009-Present

Marilyn G. Rabb (MGR) Foundation

Foreman High School Mighty Hornet Mentor Club, Co-Facilitator	2011-2012
Team M3 Chicago Marathon Mentor-Run Program, Mentor	2009-2011

Emmanuel College (Boston, MA)

Men's Varsity Basketball Strength and Conditioning Coach	2005-2006

University of Massachusetts, Amherst (UMass)

UMass Student Bridges Program, Co-Founder	2006
UMass Athletic Department, Strength and Conditioning Program Inter	2004-2006
The Shortage of Tenure-Track Faculty at UMass, Amherst, Panelist	2005
Chancellor's Commission on Campus Diversity, Student Representative	2004-2005
UMass Student Government Association (SGA), President	2004-2005
UMass Student Government Association (SGA), Commuter Senator	2002-2004
How to Live and Learn in a Diverse Community, Panelist	2004
ALANA (African, Latino, Asian, and Native American) Caucus	2002-2004
AHORA (Latino Registered Student Organization), Vice President	2002-2003
Daily Collegian, Columnist	2001-2003

City of Holyoke, Massachusetts YMCA

Youth Basketball Coach	2006-2007

H. MANUSCRIPTS IN REFEREED JOURNALS:

1. **Bustamante, E.E.,** Wilbur, J., Marquez, D.X., Fogg, L., Staffileno, B.A., Manning, A.: Physical Activity Characteristics and Depressive Symptoms in older Latino adults. *Mental Health and Physical Activity*, 6(2): 69-77, 2013.

2. Staffileno, B.A., Tangney, C.C., Wilbur, J., Marquez, D.X., Fogg, L., Manning, A., **Bustamante, E.E.,** Morris, M.C.: Dietary Approaches to Stop Hypertension Patterns in Older Latinos With or at Risk for Hypertension. *The Journal of Cardiovascular Nursing,* 28(4): 338-347, 2013.

3. Marquez, D. X., **Bustamante, E. E.,** Kozey, S., Kraemer, J., Jin, J., & Carrion, I.: Physical activity and psychosocial health of older caregivers and non-caregivers. *Geriatric Nursing*, 33(5): 358-65, (2012).

4. Wilbur, J., Marquez, D.X., Staffileno, B., Fogg, L.,Morris, M.C., Wilson, R., **Bustamante, E.E.**, & Flores, J.: The relationship between physical activity and cognition in older

Latinos. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 67(5): 525-34, 2012.

5. Marquez, D.X., Hoyem, R., Fogg, L., **Bustamante, E.E.**, Staffileno, B., & Wilbur, J.: Physical activity of urban community-dwelling older Latino adults. *Journal of Physical Activity and Health*, 8: S161-S170, 2011.

6. Marquez, D. X., Neighbors, C.J., & **Bustamante, E. E.:** Leisure time and occupational physical activity among racial/ethnic minorities. *Medicine & Science in Sports & Exercise*. 42(6):1086-1093, 2010.

7. Marquez, D. X., **Bustamante, E. E.**, Bock, B. C., Markenson, G., Tovar, A., & Chasan-Taber, L.: Perspectives of Latina and non-Latina white women on barriers and facilitators to exercise in pregnancy. *Women & Health*, 49(6-7): 505-521, 2009

8. Marquez, D. X., **Bustamante, E. E.**, Blissmer, B. J., & Prohaska, T. R.: Health promotion for successful aging. *American Journal of Lifestyle Medicine*, 3(1): 12-19, 2009.

9. Marquez, D. X., **Bustamante, E. E.**, McAuley, E., & Roberts, D.: Active or sedentary? Objectively measured physical activity of Latinos and implications for intervention. *Journal of Physical Activity and Health*, 5: 559-570, 2008.

I. MANUSCRIPTS IN REVIEW:

Marquez, D. X., **Bustamante, E. E.**, & Aguiñaga, S. (In review): BAILAMOS©: Development, Pilot Testing, and Future Directions of a Latin Dance Program for Older Latinos.

Marquez, D. X**.**, Aguiñaga, S., Campa, J., Pinsker, E., & **Bustamante, E. E.** (In preparation): A Qualitative Exploration of Factors Associated with Walking and Physical Activity in Community-Dwelling Older Latino Adults.

J. MANUSCRIPTS IN PREPARATION:

Yancey, A.K., Cole, B.L., Roby, D.H., McCarthy, W.J., **Bustamante, E.E.**, Shingole, J., Sallis, J. (In preparation): Estimated ROI of Paid Group Recess Breaks during the Workday.

Rusch, D., **Bustamante, E.E**., Frazier, S.L. (In preparation): Park district after-school programs as a setting for mental health promotion among Latino immigrant families.

K. INVITED PRESENTATIONS:

Bustamante, E.E.: Cells to Community: Current Research in Integrative Pathophysiology and Health Promotion, presentation entitled, "Physical Activity and Depressive Symptoms in Older Latino Adults." Chicago, IL. September, 2012.

Bustamante, E.E.: UIC Kinesiology and Nutrition Departmental Seminar, presentation entitled,

"Physical Activity and Life Trajectory." Chicago, IL. December, 2010.

Bustamante, E.E.: UIC College Prep (UICCP), presentation entitled, "Reducing Childhood Obesity at UICCP: An Exercise Psychology Perspective." Chicago, IL. November, 2008.

L. REFEREED PRESENTATIONS:

Bustamante, E.E., Aguiñaga, S., Bevan, J.: Physical Activity Intervention in Older Latino Adults: Processes, Challenges, and Opportunities. Symposium presented at the Midwest American College of Sports Medicine (MWACSM) Regional Meeting, Oregon, OH. November, 2012.

Bustamante, E.E., Manning, A., Staffileno, B., Fogg, L., Wilbur, J., and Marquez, D.X.: Objectively Measured Physical Activity Characteristics and Depressive Symptoms in Older Latino Adults. Poster presented at the American College of Sports Medicine Annual Meeting, San Fransisco, CA. May-June 2012.

Aguiñaga, S., Campa, J., Pinsker, E., **Bustamante, E.E**., Marquez, D.X.: Built Environment Influences on Walking in Older Latinos. Poster presented at the 33rd Annual Meeting & Scientific Sessions of the Society of Behavioral Medicine, New Orleans, LA. April, 2012.

Marquez, D. X., **Bustamante, E. E.,** & Aguiñaga, S**.:** Development and pilot testing of the BAILAMOS© dance program and its impact on physical and cognitive function in older Latinos. Paper presented as part of symposium at the annual meeting of the Gerontological Society of America, Boston, MA, November, 2011.

Bustamante, E.E. & Marquez, D.X.**:** Can Physical Activity Improve Academic Performance by Increasing Mental Persistence? A Test of Learned Industriousness. Poster presented at the American College of Sports Medicine Physical Activity, Cognitive Function, and Academic Achievement Conference, Washington, D.C. November, 2011.

Rusch, D., Frazier, S.L., **Bustamante, E.E.**, Suor, J., Reitz, K., Gabel, S., Rojas, G., & Hernandez, F.**:** Preliminary Findings from Project N.A.F.A.S.I.: Children's Mental Health in Urban After-School Programs. Poster presented at the University of Illinois at Chicago Department of Psychiatry Research Extravaganza, Chicago, IL, September, 2011.

Bustamante, E. E., Aguiñaga, S., Mendez, M., & Marquez, D. X.**:** Comparison of physical activity characteristics between four styles of Latin dance among low-active older Latinos. Poster presented at the annual meeting of the American College of Sports Medicine, Denver, CO, May, 2011.

Staffileno, B.A., Tangney, C.C., Marquez, D.X., Fogg, L., **Bustamante, E.E.**, Morris, M.C., Hoyem, R., Manning, A., & Wilbur, J.**:** At risk older Latino men and women: Blood pressure, body mass index and DASH accordance. Poster presented at the annual meeting

of the American Society of Hypertension, Hilton, NY, May, 2011.

Marquez, D. X., **Bustamante, E. E.**., Aguiñaga, S., Wilbur, J., & Mendez, M.**:** Feasibility and impact of a Latin dance program on physical activity and quality of life among older Latino adults. Poster presented at the annual meeting of the Society of Behavioral Medicine, Washington, DC, April, 2011.

Marquez, D. X.**, Bustamante, E. E.**, Aguiñaga, S., Wilbur, J., & Mendez, M.**:** Creation and impact of a Latin dance program on self-reported physical activity and enjoyment among older Latino adults. Poster presented at the annual meeting of the Gerontological Society of America, New Orleans, LA, November, 2010.

Wilbur, J.E., Marquez, D.X., Staffileno, B., Fogg, L., Morris, M.C., Wilson, R., **Bustamante, E.E**., & Flores, J.**:** Cognition and Physical Activity in Older Latinos. Poster presented at the annual meeting of the Council for the Advancement of Nursing Science, Washington, DC, September, 2010.

Marquez, D.X., Fogg, L.,Wilbur, J., & **Bustamante, E.E.:** Gender and age differences in objectively-measured physical activity among older Latino adults. Poster presented at the annual meeting of the American College of Sports Medicine, Baltimore, MD, June, 2010.

Marquez, D.X., Fogg, L., Hoyem, R., **Bustamante, E.E.**, Flores, J., Staffileno, B., Morris, M.C., Wilson, R., Loera, F., & Wilbur, J.**:** Gender and age differences in physical activity among older Latino adults. Poster presented at the annual meeting of the Society of Behavioral Medicine, Seattle, WA, April, 2010.

Marquez, D. X., **Bustamante, E. E**., Kozey, S., & Kraemer, J.**:** Physical activity and psychosocial health of older caregivers and non-caregivers. Poster presented at the annual meeting of the Society of Behavioral Medicine, Montreal, Canada, April, 2009.

Marquez, D. X., Neighbors, C.J., **Bustamante, E. E.**, & Kraemer, J.**:** The impact of occupational physical activity on LTPA participation among ethnic/racial minorities. Poster presented at the annual meeting of the Society of Behavioral Medicine, San Diego, CA, March, 2008.

Marquez, D. X., **Bustamante, E. E.**, Roberts, D., & McAuley, E.**:** Active or sedentary? Objectively measured physical activity of Latinos and implications for intervention. Paper presented as part of symposium at the annual meeting of the Society of Behavioral Medicine, Washington, DC, March, 2007.

M. PROFESSIONAL SOCIETIES:

Midwest American College of Sports Medicine (MWACSM)	2009-Present
American College of Sports Medicine (ACSM)	2008-Present
Society of Behavioral Medicine (SBM)	2008-Present
New England American College of Sports Medicine (NEACSM)	2005-2006

N. CERTIFICATIONS & CONFERENCES ATTENDED:

Illinois Early Childhood Activity Program (ICAP) Spring Workshop	2013
Motivational Interviewing Training (16-hours)	2012
Adler School of Professional Psychology Conference, "The Social Determinants of Urban Mental Health: Paving the Way Forward," Chicago, IL.	2012
CPR, AED, First Aid	2009-Present
Midwest American College of Sports Medicine (MWACSM) Regional Meeting	2009-2012
American College of Sports Medicine (ACSM) National Conference	2008-2012
Society of Behavior Medicine (SBM) National Conference	2008-2012
American College of Sports Medicine (ACSM) Physical Activity, Cognitive Function, and Academic Achievement Conference, Washington, D.C.	2011
NIH/CDC/ACSM/NCCOR Conference "Measurement of Active and Sedentary Behaviors: Closing the Gaps in Self-Report Methods," Washington, D.C.	2010
Healthy Aging Research Network Symposium: Effective Community-Based Physical Activity Programs for Older Adults: From Research to Practice, Seattle, WA	2007
New England American College of Sports Medicine (NEACSM) Regional Meeting	2005
National Conference on Race & Ethnicity (NCORE), San Fransisco, CA	2003
National Academy of Sports Medicine (NASM), Certified Personal Trainer	2002-2005