

HOW THE PROGRAM “GONOODLE” IMPACTS ATTENTION IN ELEMENTARY-AGE  
CHILDREN

A thesis presented to the faculty of the Graduate School of Western Carolina University in  
partial fulfillment of the requirements for the degree of Specialist in School Psychology.

By

Shelby Leeann Clark

Director: Dr. Candace Boan-Lenzo  
Associate Professor  
Psychology Department

Committee Members: Dr. Mickey Randolph, Psychology  
Dr. Derek Becker, Human Services

April 2023

## TABLE OF CONTENTS

|   |     |
|---|-----|
| List of Tables .....                                  | iii |
| Abstract .....  | iv  |
| Introduction .....                                    | 1   |
| Benefits of Physical Activity .....                   | 2   |
| Impact on Academic Achievement .....                  | 4   |
| Standardized Testing .....                            | 4   |
| Educational Level/Grades .....                        | 5   |
| Physical Activity Impact on Other Factors .....       | 6   |
| Attention/Memory .....                                | 6   |
| How to Increase Physical Activity .....               | 8   |
| Self-Esteem/Problem Behavior .....                    | 9   |
| Executive/Cognitive Functioning .....                 | 10  |
| Time-on-Task .....                                    | 12  |
| Future Recommendations .....                          | 12  |
| Defining Physical Activity .....                      | 14  |
| “GoNoodle” as Classroom Physical Activity .....       | 14  |
| Purpose of the Study .....                            | 15  |
| Methods .....   | 16  |
| Participants .....                                    | 16  |
| Materials .....                                       | 17  |
| Consent Form .....                                    | 17  |
| Demographic Survey .....                              | 18  |
| Classroom Physical Activity Program .....             | 18  |
| Control Group Video .....                             | 18  |
| d2 Test of Attention .....                            | 19  |
| Procedures .....                                      | 19  |
| Analysis .....  | 20  |
| Results .....   | 20  |
| Discussion .....                                      | 23  |
| Limitations of Study .....                            | 24  |
| Implications and Directions for Future Research ..... | 25  |
| References .....                                      | 26  |
| Appendices .....                                      | 31  |
| Appendix A: Informed Consent Form .....               | 31  |
| Appendix B: Demographic Survey .....                  | 33  |
| Appendix C: Tables .....                              | 34  |
| Table C1 .....  | 34  |
| Table C2 .....  | 34  |
| Table C3 .....  | 34  |

## LIST OF TABLES

|   |    |
|---|----|
| Table 1. Means and Standard Deviations for TN .....   | 21 |
| Table 2. Means and Standard Deviations for TN-E ..... | 21 |
| Table 3. Means and Standard Deviations for CP .....   | 22 |
| Table C1. Table 1 in Appendix C .....                 | 34 |
| Table C2. Table 2 in Appendix C .....                 | 34 |
| Table C3. Table 3 in Appendix C .....                 | 34 |

## ABSTRACT

### HOW THE PROGRAM “GONOODLE” IMPACTS ATTENTION IN ELEMENTARY-AGE CHILDREN

Shelby Leeann Clark

Western Carolina University (April 2023)

Director: Dr. Candace Boan-Lenzo

There are many different benefits to physical activity and exercise. Research has shown that increased physical activity can lead to improved academic achievement, concentration, cognitive functioning, and fewer disciplinary problems (e.g., Best, 2010; Pavelski, 2016; & Martin et al., 2018). Evidence suggests devoting time to daily physical activity does not negatively impact academic performance. In fact, growing evidence shows incorporating daily exercise into the classroom routine enhances attention and memory in students, as well as producing positive effects on brain health (e.g., Gomez-Pinilla, 2011; Tine, 2014; Tremblay et al., 2000). The purpose of this study was to examine the impact physical activity has on attention in fourth and fifth grade students, ages nine to eleven. Students enrolled in a Title I Public School participated in physical activity through the program GoNoodle or they participated in the control group, watching a video about the importance of physical activity. Findings indicated that students who watched the physical activity video scored significantly higher on the d2 Test of Attention compared to those who participated in the GoNoodle activity. However, both groups demonstrated improvement when comparing pre-intervention scores to post-intervention scores. Implications for future research are discussed in the paper.

## **Introduction**

There are many different benefits to physical activity and exercise. Research has shown that increased physical activity leads to improved academic achievement, concentration, cognitive functioning, and fewer disciplinary problems (e.g., Best, 2010; Pavelski, 2016; & Martin et al., 2018). Increased emphasis on improving standardized test scores has led many to believe that decreasing allotted time to, or even eliminating, physical education classes is the best course of action. This belief, while understandable, is misguided. Evidence suggests devoting time to daily physical activity does not negatively impact academic performance (Greico et al., 2016). In fact, growing evidence shows incorporating daily exercise into the classroom routine can enhance attention and memory in students, as well as producing positive effects on brain health (e.g., Gomez-Pinilla, 2011; Tine, 2014; Tremblay et al., 2000).

The impact of physical activity on academic performance has been extensively researched. The Centers for Disease Control and Prevention (CDC) recommends that children and adolescents should participate in sixty minutes or more of moderate-to-vigorous physical activity daily. Moderate to vigorous physical activity includes aerobic activities, such as running and cycling, as well as strengthening activities, such as push-ups or sit-ups. Current studies comparing more physically fit children and less physically fit children found greater brain function and structure, as well as increased performance on executive functioning tasks, in the more physically fit children (Aadland, 2017). When children and adolescents participate in the recommended sixty minutes of daily physical activity, many health benefits develop.

Unfortunately, most children today are not engaging in the recommended amount of activity (e.g., Conner, 2019; & CDC, 2021).

Schools serve as a unique place for students to meet physical activity recommendations. In North Carolina, there is a mandate on physical education and healthful living education for grades K-12, but there are no required days or minutes per week specified (NASPE, 2010). The “No Child Left Behind” Act of 2001 placed a greater emphasis on academics, which resulted in schools feeling pressure to find ways to meet standardized testing thresholds. This pressure has led schools to decrease P.E. time and resources in order to increase time focused on mathematics and reading. The consequences of decreased physical activity time and resources have not been closely examined and are not fully understood. However, evidence that physical activity has an impact on academic achievement can be found throughout literature and through research. This review of literature explores the benefits of physical activity, the impact it has on other factors (executive functioning, cognitive functioning, attention, memory, and self-esteem), how it affects academic achievement, and recommendations for future research.

### **Benefits of Physical Activity**

Physical activity and exercise can mean different things to different people. The World Health Organization (WHO) defines physical activity as “all bodily movement generated by skeletal muscles that require energy disbursement” (WHO, 2020). Physical activity does not necessarily have to be vigorous exercising, though both moderate and vigorous intensity exercise does improve health (e.g., CDC, 2021; Aadland et al., 2017; & Greico et al, 2016). Physical activity refers to an array of movement that an individual makes such as getting from one place to another, moving at a workplace or school, and any movement made during leisure time. Evidence suggests that for young children, physical activity is especially important because it

improves overall health, academic achievement, cognitive functioning, mood, and it influences the brain (Buscemi, 2014). Considering schools are uniquely positioned to incorporate physical activities in the curriculum and physical education classes, school-aged children should be participating in the recommended amount of time of daily physical activity.

The importance of physical activity cannot be overlooked in the school setting. Not only does physical activity have long term benefits for children's physical health and academic achievement, but it also has immediate benefits as well, such as improved attention and memory on classroom tasks, and a decrease in inappropriate behavior, such as being unfocused and distracting others, following exercise (e.g., Tine, 2014; Goh, 2017; Greico et al, 2016). Regarding long term benefits of developmentally appropriate physical activity for children, improved physical fitness over time can potentially have positive effects on writing, reading, and mathematics (Castelli, 2015). Research has shown that when comparing groups of children who are participating in some type of physical activity at school to groups of children who are not engaging in physical activity and are learning while being sedentary, the group of children who are learning while being physically active do better academically, compared to their sedentary peers. Specifically, research shows that physical activity has a positive impact on all school aged students within the academic areas of math, reading, and spelling; however, elementary aged students are the most impacted (e.g., Conner et al., 2019; Lorenz, et al. 2017; Rasberry, et al., 2011).

There is ample evidence that physical activity has a positive impact on mental health for individuals of all ages. With greater emphasis being placed on standardized testing, students are feeling the stress of having to perform well. School authorities should be able to monitor students' mental health and support them by providing suitable physical exercise programs as

well as supporting students along their educational path, especially when they are undergoing important assessments (Theodoratou et al., 2020). Finally, physical activity is important for brain health and development in young children. Research has shown that many types of physical activity require one to direct their attention, switch their attention between tasks, and move information from short-term to long-term memory. Each of these brain processes are necessary measures for learning. Due to adequate research providing evidence that physical activity has numerous benefits associated with it, having schools incorporate it into the classroom curriculum is a justifiable use of valuable school time.

### **Impact on Academic Achievement**

Research has shown that there are many benefits of physical activity that impact academic achievement. Explored in this review are impact on standardized testing and educational levels and grades.

**Standardized Testing** According to the National Assessment of Educational Progress (NAEP), a project of the Federal Education Department, standardized testing scores have decreased over the years across grade levels. When specifically looking at North Carolina scores, in 2019 the average NAEP 4<sup>th</sup> grade reading score was 221 out of a possible 500, down from 224 in 2017. The percentage of students in North Carolina who performed at or above the NAEP Proficient level in 2019 was 36 percent compared to 39 percent in 2017 (NAEP, 2019). As stated previously, there are many benefits to increasing physical activity in the school setting. One area that is positively impacted by increasing physical activity is standardized test scores. It is important to note that the students who benefit most from increasing physical activity in their daily lives are those that have more room for improvement in their academics. In a study discussed by Conner et al. (2019), and conducted by Resaland et al. (2018), students who were



placed in the “low” academic category were the ones who gained the most after engaging in physical activity breaks and active learning. These “low” achieving students gained between 10% to 20% on academic assessments administered, which evaluated math, reading, and English (Resaland, 2018).

In one study that focused on the association of a large diverse student population, physical activity, and academic achievement, evidence showed a significant positive relationship between fitness and Math and English academic achievement in students between the ages of 9 and 13 (Chomitz et al., 2009). This finding is congruent with many other research studies that have examined the relationship between physical activity and academic achievement.

**Educational Level/Grades** The emphasis that has been placed on standardized testing and academic performance has led to a decrease in physical activity, which has potentially negative implications for young students. Several studies have shown that being physically active is associated with a lower risk of developing metabolic and cardiovascular diseases, as well as positive cognitive and academic achievement effects in children. Many studies have examined the impact that physical activity has on standardized test scores, not teacher-assigned grades. The problem with only looking at standardized testing scores is that the findings are based on one day of testing and not an entire school year. Some students may struggle with test anxiety, in which the examiner isn't obtaining a true representation of the students' academic ability.

Lorenz and colleagues examined whether the relationship between physical activity and grades was moderated by ethnic background, body composition, or gender or whether these characteristics contributed distinctive variation to teacher-assigned grades. Fourth grade students' physical activity was assessed by using the FITNESSGRAM, an assessment that examines five components of physical fitness that include cardiovascular endurance, muscular strength and

endurance, flexibility, and body composition. Results showed that the influence of aerobic fitness on academic performance is consistent, not dependent on ethnicity, body composition, or gender of a student (Lorenz et al., 2017). Yet another important finding from this study includes the impact that physical activity has on subjects such as science and writing. While a majority of research looking at the impact of physical activity on academic achievement focuses on mathematics and reading scores, Lorenz and colleagues included science and writing as well. They found that not only does physical activity have a positive impact on reading and mathematics, but it also has a positive impact on science and writing. In a similar study that focused on grades rather than standardized testing found that adolescents who stated they participated in school-based physical activities such as physical education and team sports, or who were physically active with their parents were 20% more likely to earn an “A” in mathematics or English compared to their sedentary peers (Troost, 2009).

### **Physical Activity Impact on Other Factors**

Several other factors are reportedly impacted by physical activity. Included in this review are executive functioning, cognitive functioning, attention, memory, problem behavior, self-esteem, as well as future recommendations.

**Attention/Memory** Attention and working memory are both essential when learning new information. Attention allows information to be taken in, while working memory helps the brain make sense of that information (Rosen, n.d.). There are four key components of attention, which include alertness, selection, sustaining, and shifting. Working memory allows individuals to use new and learned information while in the middle of an activity and use it so it has meaning and relevance. Students who struggle academically may have attention and working memory difficulties.

Selective visual attention (SVA), the ability to remain focused on a relevant visual input while suppressing other irrelevant inputs, has been an identified difficulty among low-income children and adolescents (Tine, 2014). If a student is unable to focus on a specific task and ignore distractions in the classroom, it will be difficult for them to learn and retain information. Therefore, SVA is essential for students to gain new knowledge and succeed in school. In a previous study conducted by Tine and colleagues (2014), they found that after children engaged in acute bouts of aerobic exercise, their SVA increased significantly. Interestingly, results showed that after exercising, low-income children exhibited an even greater increase in SVA compared to their high-income peers. In a more current study conducted by Tine (2014), the focus was on low-income *adolescents* to determine if the effects were similar to those of younger children, instead of assuming the results are generalizable to an older population. One important reason for conducting an additional study is the fact that young children's SVA is still developing, while adolescents SVA is fully developed. The control group in this study engaged in watching a 12-minute movie that resulted in no improvement of SVA. However, after a group of adolescents engaged in acute bouts of an aerobic exercise (e.g., jogging in place at a speed that maintained a heart rate within their individual heart rate range), less than 20 minutes, the SVA of both low- and high-income adolescents improved greatly. The low-income adolescents SVA improvement was so significant that the pre-existing educational gap between low- and high-income adolescents diminished (Tine, 2014).

The results from this study provide important information for schools with young children and adolescents of both low and high-income (Tine, 2014). After engaging in small amounts of physical activity, the attention and focus of students increased significantly for both low- and high-income students of differing ages. Even more important is the finding that

engaging in small amounts of physical activity is especially beneficial for low-income students. This research finding should prompt schools to incorporate small bouts of exercise for their students to help improve their attention and focus in the classroom, which could also result in higher academic achievement.

One study, conducted by Pesce and colleagues (2009), compared two types of aerobic exercise of equivalent intensity, and the impact on preadolescents memory (immediate word recall and delayed recall). Specifically, they looked at the impact of circuit training, which created opportunities for the children to learn motor skills, and they also examined the impact of group games, which created opportunities for the children to apply motor skills in a strategic and competitive fashion. Evidence showed that for delayed recall, both forms of exercise benefited memory performance. Whereas, for immediate word recall, only the aerobic group games enhanced memory comparable to baseline memory performance (Best, 2010).

### **How to Increase Physical Activity**

One proposed way of incorporating increased amounts of physical activity in schools is through classroom-based physical activities. Classroom-based physical activity typically means taking small active breaks throughout teaching academic content or including physical activity in academic instruction. Evidence from literature has been consistent in showing that physical activity is related to many different benefits for children and adolescents. For example, physical activity has been shown to improve classroom behaviors such as increased time-on-task, better concentration, and reduced fidgeting (Donnelly et al., 2011). As stated previously, attention to a classroom task is essential for learning and, consequently, can have an impact on other areas of classroom management such as discipline.

**Self-esteem/Problem Behavior** Evidence that links health and physical activity is stronger for adults compared to children and adolescents. However, healthy habits that are established in childhood influence the likelihood that an individual will be active as an adult and continue those healthy habits. Numerous research studies have reported that participating in physical activity has a positive impact on self-esteem (e.g., Tremblay et al., 2000; Theodoratou et al., 202; & Trost, 2009). The development of self-esteem is linked to several underlying factors for young students, including persistence, motivation, and academic success, and is therefore a primary goal for many elementary schools. A group of 6<sup>th</sup> grade students who either participated in aerobic activities that resulted in higher levels of heart rate, strengthening activities that include participating in sit-ups or push-ups, and stretching activities such as toe-touching or leg-stretching, demonstrated progressive improvements in self-esteem for both males and females (Tremblay et al., 2000). Self-esteem has a number of positive factors related to it. Unfortunately, self-esteem tends to decline as children grow older and transition into adolescence, especially for females. Tremblay and colleagues' research findings suggest that having students participate in physical activities, particularly vigorous physical activity, may help them overcome struggles and navigate this difficult period of their lives.

Physical activity has been shown to have an association with mental health. Research on internalizing behaviors, such as anxiety and depression, and externalizing behaviors, such as aggression and rule breaking, tend to support a counter relationship between physical activity and problem behaviors. This means that increased levels of physical activity are correlated with decreasing levels of problem behaviors (Pavelski, 2016). The CDC conducted a review and found that individuals in the United States who are more active were less likely to develop depressive symptoms compared to those who are primarily inactive. Similar to the Tremblay and

colleagues' study, the CDC also found a negative relationship between physical activity, or sport participation, and depression and anxiety, as well as a positive relationship between physical activity and self-esteem. Pavelski determined that the best results for a decrease in problem behavior include participation in regular vigorous aerobic exercise, strengthening activities, and/or resistance exercises for three or more days per week.

**Executive/Cognitive Functioning** Recent experimental research has found that moderate to vigorous aerobic exercising promotes young children's goal-directed and effortful cognition and behavior, which is often referred to as executive functioning (EF). The blanket definition of executive function is highly debated. However, one distinguished theoretical framework proposes that EF consists of three foundational components which includes inhibition, shifting, and updating of working memory (Best, 2010). Best analyzed a series of experimental research examining the effects of physical activity on children's executive functioning. He compared two different studies: one that incorporated complex, coordinated exercise, and one that incorporated competitive, aerobic games. Best found that the coordinated exercising required substantial top-down cognitive control and the ability to override automatic behaviors, and the aerobic games required cooperation with peers, strategic behavior, adaptation to continually change task demands, and coordination of complex bodily movement. When comparing the two studies, and the two different exercising techniques, he determined that the more complex an exercise is, the greater the impact it has on EF, as compared to simpler exercises (Best, 2010).

Some studies have looked at the impact physical activity has on specific groups of children. Martin and colleagues (2018) examined the differences between two groups of children, those with obesity and those with a healthy weight, and how physical activity and diet affect their academic achievement and cognition. Research suggests that children with obesity

tend to show higher inattention and impulsivity, as well as lower reward sensitivity, cognitive flexibility and self-regulation compared to their peers who have a healthier weight (Martin et al., 2018). Evidence found that intense interventions involving daily physical activity and/or nutrition education can have a significant change in obesity and cognitive outcomes when compared to standard practice.

In a similar study that examined the effects of physical activity in combination with dietary management, researchers found that exercise in combination with diet can provide more beneficial effects than intervention alone (Gomez-Pinilla, 2011). As stated previously, a strong emphasis has been placed on doing well in school, scoring high on standardized tests, and accomplishing as much as possible in one day. This type of stress can take a toll on an individual's mental health. Research has shown that a focus placed on standardized testing has decreased the amount of time that children are able to be physically active, which can lead to an unhealthy weight. A reduction in physical activity, in combination with an unhealthy diet, has the potential to increase the risk of neurological disorders such as depression and anxiety. Gomez-Pinilla examined a number of animal and human studies that focused on physical activity and diet, and their impact on molecular events related to the management of energy metabolism and synaptic plasticity. Evidence from these studies have shown that physical exercise and diet influence certain molecular systems, which in turn can make the brain more resistant to damage, and it can improve cognitive abilities (Gomez-Pinilla, 2011). Given the findings from these studies, a feasible strategy that could likely combat the risk of depression and anxiety would be to use this information to implement physical activity programs and dietary policies in schools as well as the community.

**Time-On-Task** Another area that is positively impacted by increasing physical activity in schools is time on task (TOT) behaviors. Grieco et al. defines TOT as the time students spend attending to school related tasks. TOT is a direct measure of attention, behavioral control, and student engagement, all of which are positively correlated with academic performance. Previous studies have found that when students engage in active lessons, their TOT behaviors increase immediately. Contradictory results were found when Grieco et al. (2016) conducted a similar study with third and fourth grade students. She found that after one group of students engaged in active lessons, there was no change in their TOT behaviors. However, students who were not engaging in active lessons, those who were learning while being sedentary, showed a decrease in TOT behaviors (Grieco et al., 2016). Despite the differences found in Grieco's study compared to previous studies, having students engage in active lessons still has a positive effect on their TOT behaviors, whether that be increasing their TOT behaviors or preventing a decrease in TOT behaviors.

### **Future Recommendations**

Although many research studies have found positive correlations between physical activity and academic achievement, one must consider the type of study that was conducted, the sample size, the duration of the study, and whether or not the participants were randomized. Rasberry and colleagues identified fifty published reports and peer reviewed studies that addressed the association between four school-based physical activity contexts and indicators of academic performance including cognitive skills and attitudes, academic behaviors, and academic achievement. There were many groups of studies examined in Rasberry's systematic review. These groups include the relationship between physical activity and academics, school-based physical education and academic performance, recess and academic performance,



classroom physical activity and academic performance, and extracurricular activities and academic performance. The majority of findings showed a positive correlation or no correlation at all between the four school-based physical activity contexts and academic performance. There are many explanations for the positive relationship versus no significant relationship findings that include; having small samples, making it difficult to determine statistical significance, intensity and duration of the physical activity, individual differences of participants, quality of implementation of intervention, and the context in which the physical activity took place.

Similarly, Santana and colleagues conducted a systematic review of literature that examined physical fitness and academic performance in youth. They found strong evidence for a positive correlation between cardiorespiratory fitness and academic performance in cross-sectional studies, a positive association between physical fitness and academic performance, as well as strong evidence from longitudinal studies for a positive association between physical fitness and academic performance. However, these findings should be interpreted with caution due to the fact that they are based on cross-sectional, short-term, small samples, nonrandomized trials, and randomized trials with high risk of bias (Santana et al., 2017). Santana and colleagues suggest that future research evidence could be strengthened by conducting longitudinal research and follow-up assessments in order to provide a better understanding of the long-term effects that physical fitness has on academic performance.

Between the two systematic reviews of literature, there is a pattern of physical activity having either a positive impact on academic achievement or no statistical significance between the two. This is an important pattern that has been consistent throughout the literature. Considering this consistent pattern, and lack of negative association between physical activity and academic achievement, it suggests that incorporating physical activity in the school day may

enhance, and will not diminish, academic achievement (e.g., Rasberry et al., 2011; Koivusilta et al., 2012; Santana et al., 2017).

### **Defining Physical Activity**

As mentioned previously, classroom-based physical activities are an effective way to incorporate increased amounts of physical activity during the school day. Classroom-based physical activity means taking small active breaks throughout academic instruction. Acute physical exercise is typically defined as engaging in an activity for less than 20 minutes (Tine, 2014; Basso, 2017). According to the Cleveland Clinic (2021) there are three heart rate zones that an individual can be in while exercising, the lower-intensity zone (50-60% maximum heart rate), the temperate zone (60-70% maximum heart rate), and the aerobic zone (70-80% maximum heart rate). Tine and colleagues conducted a study that tested to see if children's selective visual attention (SVA) improved after engaging in acute sessions of aerobic activity, a single session lasting less than 20 minutes and at a cardiovascular intensity of 70-80% of the child's maximum heart rate. This research study found that the children's SVA improved significantly after engaging in acute physical activity in the classroom (Tine, 2014).

### **“GoNoodle” as Classroom Physical Activity**

Classroom-based physical exercise can look like a variety of different activities. A program called “GoNoodle” is a movement and mindfulness program dedicated to empowering children and creating good energy, making screen time active time. This program is being utilized in four-out-of-five U.S. public elementary schools and in millions of homes (hundrED, 2019). “GoNoodle” is a research-based program that is designed for grades K-5, that is healthy for the body, engaging for attention, and beneficial for the brain in multiple ways (GoNoodle, 2019). There are a variety of video and game lengths available on the “GoNoodle” website,

ranging from 1 minute to 20 minutes, that the teacher can project on a screen for the entire class to participate in unison or in a separate space for an individual child or small groups to participate in. Modules are broken down into nine activity types: 1) brainercise, 2) breathe, 3) call & repeat, 4) freestyle, 5) guided dance, 6) how to, 7) partner up, 8) stretch, and 9) workout. Although there are modules that are meant for relaxing and calming the body, this thesis will use the phrase *physical activity breaks* and use the modules (e.g., workout) that get the students' heart rates up. Some activities that will be used include exercise routines and dance.

The “GoNoodle” program has been proven to be effective in a study conducted by Hannah Wold, who looked at utilizing the program to take active brain breaks in four second and third grade classrooms. Wold sought to determine if engaging in 10-12 minutes of brain breaks through “GoNoodle” would impact reading fluency. Wold found that the most notable effects on reading fluency occurred directly after the acute physical activity breaks. This research study suggests that short-term, acute bouts of physical activity require a great deal of consistency before notable long-term benefits arise (Wold, 2019). Specifically, Wold determined through their research findings that the acute effects on reading fluency were much more pronounced compared to the long-term effects.

### **Purpose of the Study**

Due to an increased focus on standardized testing in the schools, physical activity has become less of a concern and physical education classes are now considered less important. However, physical activity has been shown to improve overall health, academic achievement, cognitive functioning, mood, and it has positive influences on the brain (Buscemi, 2014). Most research that focuses on the benefits of physical activity in children looks at broad areas such as academic achievement, cognitive functioning, or executive functioning. With limited research

narrowing their focus, little is known about the impact physical activity has on specific areas such as improved attention. Therefore, this research project will involve looking at the impact of acute physical activity on executive functioning skills, specifically improved attention, in elementary aged children using a program called “GoNoodle”.

Based on the review of the literature one hypothesis and two research questions were developed.

### *Hypothesis*

By engaging in acute bouts of physical activity, through the use of “GoNoodle”, the attention of elementary age children will significantly increase.

### *Research Question 1*

Will the students’ (at Ray Childers Elementary School) ability to process more items on the attention measure, after engaging in the program “GoNoodle”, increase compared to before using the program?

### *Research Question 2*

Will Implementation of GoNoodle result in significantly improved performance at post-test compared to control group?

## **Methods**

### **Participants**

Participants included 65 students who attended a Title One public school in North Carolina. A total of four classrooms participated including two fourth grade classes and two fifth grade classes. All participants (33 females and 32 males) and their caregivers were informed of the study procedures and of their right to agree or disagree to participate in the study without any

negative consequences. Though a demographic form was administered to parents with the consent form, many of them declined to answer. Feedback from the teacher indicated that some parents thought the questions were too invasive or too personal.

One 4<sup>th</sup> grade classroom (n=32) and one 5<sup>th</sup> grade (n=33) classroom were assigned as the experimental group who participated in 10 minutes of acute physical exercise using the program “GoNoodle”. The other 4<sup>th</sup> and 5<sup>th</sup> grade classes were assigned as the control group who participated in watching a video about the importance of physical activity and healthy habits for the same length of time. Of the four classrooms that were included in the study, two consisted of fourth-grade students and two consisted of fifth-grade students between the ages of 9 and 11, with a mean age of 9.8. School demographics are reported as 70.6% White, 12% Hispanic, 10.4% Asian, and 7% other ethnicities (African American, American Indian, two or more races). 60.9% of students are currently receiving free or reduced lunch. Based on the limited demographic information obtained, there were no differences in mean age or gender between the control and experimental group.

## **Materials**

### **Consent Form**

A caregiver consent form was given and detailed the purpose of the study (See Appendix A). The consent form explained how the information gained from this study may provide a better understanding about the impacts of physical exercise on student attention. There were no foreseen risks to caregiver involvement in this study. However, the children participating in this study did engage in physical activity. Any involvement in physical activity is a risk for injury, so

participants' safety was monitored by their teachers and the researcher. The program “GoNoodle” was used appropriately to lower the risk of injury. All identifying information was destroyed at the conclusion of the data analysis.

### **Demographic Survey**

A demographic survey (See Appendices B) was included. The survey gathered information about the child’s race and age, household income, and parent(s) level of education. All parents were presented with these questions and asked to answer if applicable. Around fifty percent of the demographic surveys were filled out and returned with the consent form; therefore, general demographic information about Ray Childers’ population was utilized. All identifying information was destroyed at the completion of the data analysis.

### **Classroom Physical Activity Program**

“GoNoodle” is a free physical activity program available to the public at any time or place where there is Internet access. The 4<sup>th</sup> and 5<sup>th</sup> grade teachers of the experimental group used a projection system to display a “GoNoodle” activity on the screen for the entire class to engage in 10 minutes of physical activity. The experimental groups chose an activity to engage in under the activity type of “indoor recess”, where there were a variety of videos to choose from. Specific physical activity that the experimental group participated in included running in place, and copy dance moves that required them to reach their arms up high and jump up and down. These videos range from 7 minutes to 15 minutes of physical activity; however, the 4<sup>th</sup> and 5<sup>th</sup> grade groups only participated for a total of 10 minutes.

### **Control Group Video**

The 4<sup>th</sup> and 5<sup>th</sup> grade classrooms who did not participate in the “GoNoodle” physical activities watched an educational video that discussed the benefits of physical activity and the

importance of healthy habits. The 4<sup>th</sup> and 5<sup>th</sup> grade teachers used a projection system to display the video on the screen for the entire class to watch for 10 minutes.

## **d2 Test of Attention**

Finally, student attention levels were assessed by completing the d2 Test of Attention. The d2 Test of Attention measures processing speed, quality of performance, and rule compliance, allowing for an estimation of concentration performance and individual attention. This test was completed with paper and pencil, and provided accurate, reliable, and valid data in order to determine the level of improved attention between groups. When taking this test, participants were asked to cross out any letter “d” with two marks above or below it. There were surrounding distractors included that were similar to the target stimulus, the letter “d”, such as the letter “p” with two marks or the letter “d” with one or three marks. Three scores were obtained after students completed the test including TN (total number of items processed), TN-E (total number of items processed minus error scores), and CP (concentration performance). Concentration performance can also be described as the number of items the students correctly crossed out. The d2 Test of Attention was administered directly before the “GoNoodle” activity or before watching the Physical Activity Video, as well as directly after engaging in those activities. The test was administered in a group format within 8 minutes each. Extensive norms based on a German sampling of over 6,000 participants are available as well as preliminary United States norms for children, college students, and the elderly (Hogrefe, 2022).

## **Procedures**

The Institutional Review Board (IRB) at Western Carolina University approved this study. Participants were selected by attending Ray Childers elementary school and by being students in a 4<sup>th</sup> or 5<sup>th</sup> grade classroom. Caregivers reviewed and completed the consent form

(See Appendices A). Following consent, caregivers were asked to complete the demographic survey (See Appendix B). At school, students engaged in 10 minutes of physical activity during science and social studies time from 1:00-1:45pm and 2:00-2:45pm. This occurred on Monday, March 20, for a total of one day in the fourth and fifth grade classrooms using the program “GoNoodle”. Before engaging in the “GoNoodle” activity, or before watching the physical activity video, students were asked to complete the d2 Test of Attention. Lastly, one minute after students engaged in the acute bouts of physical activity, they were asked to complete the d2 Test of Attention again. Two groups participated in the “GoNoodle” activity, 30 4<sup>th</sup> and 5<sup>th</sup> grade students total, and 2 groups engaged in watching the physical activity video, 35 students total.

### **Analysis**

A series of 2 x 2 mixed model ANOVAs were used to analyze the data. For all ANOVAs, the within subject variable was time (pre-intervention/post-intervention) and the between subjects variable was condition (physical activity video control group/GoNoodle experimental group). The dependent variables differed across ANOVAs. They included: Total Number of Items Processed (TN), Total Number of Items Processed minus Error Scores (TN-E), and Concentration Performance (CP).

### **Results**

#### **Hypothesis Testing**

The first mixed model ANOVA examined differences on Total Number of Items Processed (TN) based on group condition. All participants completed a pre-intervention and post-intervention assessment, which served as the within-subjects variable. The between subjects variable was condition: Physical Activity Video Group (Control) versus GoNoodle Group. There was a significant main effect for the within-subjects factor,  $F(1, 62) = 37.48, p < .001$ . There



was no main effect for condition,  $F(1, 62) = .90, p = .35$  nor an interaction effect,  $F(1, 62) = .07, p = .79$  (As shown in Table 1).

**Table 1 - Research Question 1**

*Means and standard deviations for TN*

| Group                                   | Pre-Intervention Mean (SD) | Post-Intervention Mean (SD) |
|---|----------------------------|-----------------------------|
| Physical Activity Video Group (Control) | 104.8 (1.7)                | 115.1 (2.0)                 |
| GoNoodle Group                          | 102.4 (1.8)                | 113.6 (2.1)                 |

The second mixed model ANOVA examined differences on Total Number of Items Processed Minus Error Scores (TN-E) based on group condition. All participants completed a pre-intervention and post-intervention assessment, which served as the within-subjects variable. The between subjects variable was condition: Physical Activity Video Group (Control) versus GoNoodle Group. There was a significant main effect for the within-subjects factor,  $F(1, 62) = 32.36, p < .001$ . There was no main effect for condition,  $F(1, 62) = 1.45, p = .24$  nor an interaction effect,  $F(1, 62) = .04, p = .85$  (As shown in Table 2).

**Table 2 – Research Question 2**

*Means and standard deviations for TN-E*

| Group                                   | Pre-Intervention Mean (SD) | Post-Intervention Mean (SD) |
|---|----------------------------|-----------------------------|
| Physical Activity Video Group (Control) | 101.4 (39.1)               | 128.8 (46.2)                |
| GoNoodle Group                          | 111.5 (24.3)               | 137.1 (27.6)                |

The second mixed model ANOVA examined differences on Concentration Performance based on group condition. All participants completed a pre-intervention and post-intervention assessment, which served as the within-subjects variable. The between subjects variable was condition: Physical Activity Video Group (Control) versus GoNoodle Group. There was a significant main effect for the within-subjects factor,  $F(1, 62) = 28.75$   $p < .001$ . There was a significant main effect for condition,  $F(1, 62) = 8.1$ ,  $p = .006$ . The GoNoodle Group scored significantly lower than the Physical Activity Video (Control) Group, which did not support the hypothesis of this study. There was not an interaction effect,  $F(1, 62) = .03$ ,  $p = .86$  (As shown in Table 3).

**Table 3 - Hypothesis**

*Means and standard deviations for CP*

| Group                                   | Pre-Intervention Mean (SD) | Post-Intervention Mean (SD) |
|---|----------------------------|-----------------------------|
| Physical Activity Video Group (Control) | 106.47 (11.6)              | 115.0 (11.0)                |
| GoNoodle Group                          | 100.6 (7.5)                | 109.7 (10.0)                |

## **Discussion**

This study examined the immediate impact of a physical activity break on improved attention. While many individuals recognize the importance of physical activity in young children for improving overall health, cognitive functioning, academic achievement, and mood (Buscemi, 2014), these results indicate that an increase in attention is also possible. Although the control group demonstrated greater improved attention, the GoNoodle group also increased their attention as evidenced by improved concentration performance scores overall. It is well known that improving overall attention is essential when learning new information. If a student is unable to focus on a specific task and ignore distractions in the classroom, it will be difficult for them to learn and retain information. Research has shown that single sessions of physical activity can increase attention and memory (e.g., Best, 2010; Tine, 2014; & Rosen, 2021). Additionally, time on task (TOT) is a direct measure of attention, behavioral control, and student engagement, all of which are positively correlated with academic performance. Previous studies have found that when students engage in active lessons, their TOT behaviors increase immediately. This study looked at improving attention through engaging in physical activity to meet these specific needs.

TN is a measure of an individual's total number of items processed on the d2 Test of Attention. TN-E is a measure of an individual's total number of items processed minus errors made. Lastly, CP is a measure of concentration performance and looks at correctly crossed out relevant items. This study hypothesized that the students engaging in the GoNoodle activity would improve their score significantly more than their peers in the control group in each area. The data did not confirm this hypothesis as the GoNoodle group scored lower than the Physical Activity Video (control) group on concentration performance. In general, both groups increased from pre-intervention to post-intervention when looking at concentration performance; however, the control group scored significantly higher than the physical activity group.

### **Limitations of Study**

Several limitations of this study exist. First, is the quasi-experimental nature of the research. This study only examined the impact of physical activity on attention in the fourth and fifth grade. Using only fourth and fifth grade students for this study limited our knowledge of how other age ranges respond to physical activity regarding improved attention. Therefore, results are not representative of an entire elementary-age population.

Another limitation of this study is that it only looked at the impact of one specific exercise program. This study utilized GoNoodle as the sole program for students to engage in physical activity. GoNoodle is a program that is available to all educators, free of cost, and is a convenient way for students to engage in physical activity within the classroom setting. However, there are other exercise programs available to educators that could be explored.

Another limitation is the amount of data collected. Data collection occurred on one day, obtaining only two total data points across the different areas (pre-intervention & post-intervention). Ideally, students would have engaged in the physical activity program on multiple occasions, across multiple weeks, allowing for additional information including chronic effects of physical activity on attention. Additionally, differences were apparent in baseline scores between experimental and control groups. These differences ideally would have been controlled for when analyzing data.

Lastly, another limitation is the small participant size and the samples' demographics. This study included 65 total participants within the fourth and fifth grades. Specific demographic information was not obtained with the participation group; however, the school's population is majority White. Therefore, findings are not generalizable to the entire population. Additionally, this study would have ideally included a greater number of participants.

### **Implications and Directions for Future Research**

This current study aimed to examine the immediate impact of physical activity on improved attention. Based on the findings of overall improvement in concentration performance

from pre-intervention to post-intervention in the physical activity group, all students would likely improve their attention after engaging in acute physical activity. As stated previously, there is a lack of research examining the effects of physical activity on improved attention. This study should be replicated and expanded on a greater scale.

Future studies can build on, refine, or add elements of this study. In addition, researchers could also include students in middle and high school. Specifically, future research should include a larger population size as well as a more representative demographic sample. Would findings be similar within the middle and high school settings? Would we see differences with a larger, more diverse, sample size?

Future studies should address the limitations of this study and work to decrease or eliminate them. Data collection should occur across multiple days to obtain long-term effects of physical activity on attention.

## REFERENCES

- Aadland, K. N., Moe, V. F., Aadland, E., Anderssen, S. A., Resaland, G. K., & Ommundsen, Y. (2017). Relationships between physical activity, sedentary time, aerobic fitness, motor skills and executive function and academic performance in children. *Mental Health and Physical Activity*, 12, 10–18. <https://doi.org/10.1016/j.mhpa.2017.01.001>
- About GoNoodle. GoNoodle Knowledge Base. (2019). Retrieved May 30, 2022, from <https://support.gonoodle.com/article/241-what-is-gonoodle>
- Basso, J. C., & Suzuki, W. A. (2017). The Effects of Acute Exercise on Mood, Cognition, Neurophysiology, and Neurochemical Pathways: A Review. *Brain plasticity (Amsterdam, Netherlands)*, 2(2), 127–152. <https://doi.org/10.3233/BPL-160040>
- Best, J.R. (2010). Effects of Physical Activity on Children’s Executive Function: Contributions of Experimental Research on Aerobic Exercise. *National Institute of Health*, 30(4). doi: 10.1016/j.dr.2010.08.001
- Buscemi, J., Kong, A., Fitzgibbon, M. L., Bustamante, E. E., Davis, C. L., Pate, R. R., Wilson, D. K., & Society of Behavioral Medicine Health Policy Committee (2014). Society of Behavioral Medicine position statement: elementary school-based physical activity supports academic achievement. *Translational behavioral medicine*, 4(4), 436–438. <https://doi.org/10.1007/s13142-014-0279-7>
- Castelli, D.M., Glowacki, E., Barcelona, J.M., Calvert, H.G., & Hwang, J. (2015). Active Education: Growing Evidence on Physical Activity and Academic Performance. [Research brief.] *Active Living*.

Centers for Disease Control and Prevention. (2021). How much physical activity do children need?

*Centers for Disease Control and Prevention.*

<https://www.cdc.gov/physicalactivity/basics/children/index.htm>

Chomitz, V., Slining, M., McGowan, R., Mitchell, S., Dawson, G., Hacker, K., (2009). Is there a relationship between physical fitness and academic achievement? Positive results from public school children in the northeastern United States. *Journal of School Health*, 79(1), 30.

Cleveland Clinic. (2021). Exercise Heart Rate Zones Explained. Sports Health & Fitness. Retrieved May 30, 2022, from <https://health.clevelandclinic.org/exercise-heart-rate-zones-explained/>

Conner, J., (2019). The Impact of Increased Physical Activity on Academic Achievement. 35.

Donnelly, J. E., Lambourne, K. (2011). Classroom-based physical activity, cognition, and academic achievement. *Preventative Medicine*, 52, S36-S42. <https://doi.org/10.1016/j.ypmed.2011.01.021>

Goh, T. L. (2017). Children's Physical Activity and On-Task Behavior Following Active Academic Lessons. *Quest (00336297)*, 69(2), 177–186.

Gomez-Pinilla, F. (2011). The combined effects of exercise and foods in preventing neurological and cognitive disorders. *National Institute of Health*, 52, S75-S80.

<https://doi.org/10.1016/j.ypmed.2011.01.023>

Grieco, L. A., Jowers, E. M., Errisuriz, V. L., & Bartholomew, J. B. (2015;2016;). Physically active vs sedentary academic lessons: A dose response study for elementary student time on task.

*Preventive Medicine*, 89, 98-103. <https://doi.org/10.1016/j.ypmed.2016.05.021>

hundrED. (2019). GoNoodle. GoNoodle. Retrieved May 30, 2022, from

<https://hundred.org/en/innovations/gonoodle>

Indoor Recess. GoNoodle. (n.d.). Retrieved June 23, 2022, from

[https://app.gonoodle.com/search?filters%5Bduration\\_slug%5D=10-plus-minutes](https://app.gonoodle.com/search?filters%5Bduration_slug%5D=10-plus-minutes)

- Koivusilta, L. K., Nupponen, H., & Rimpelä, A. H. (2012). Adolescent physical activity predicts high education and socio-economic position in adulthood. *European Journal of Public Health*, 22(2), 203–209. <https://doi-org.proxy195.nclive.org/10.1093/eurpub/ckr037>
- Lorenz, K. A., Stylianou, M., Moore, S., & Kulinna, P. H. (2017). Does fitness make the grade? The relationship between elementary students' physical fitness and academic grades. *Health Education Journal*, 76(3), 302–312. <https://doi.org/10.1177/0017896916672898>
- Martin, A., Booth, J. N., Laird, Y., Sproule, J., Reilly, J. J., & Saunders, D. H. (2018). Physical activity, diet and other behavioural interventions for improving cognition and school achievement in children and adolescents with obesity or overweight. *Cochrane Database of Systematic Reviews*, 1. <https://doi.org/10.1002/14651858.CD009728.pub3>
- National Association for Sport and Physical Education and the American Heart Association. (2010). North Carolina State Profile. <http://www.naspeinfo.org/shapeofthenation>
- Pavelski, A. L., (2016). Assessing the mediating effect of student problem behavior on the relationship between physical activity and academic achievement in the intermediate grades. Dissertation. 12-47.
- Pesce C, Crova C, Cereatti L, Casella R, Bellucci M., (2009). Physical activity and mental performance in preadolescents: Effects of acute exercise on free-recall memory. *Mental Health and Physical Activity*, 2, 16–22.
- Product Description. D2 - D2 test of Attention – Hogrefe Publishing. (2022). Retrieved June 19, 2022, from <https://www.hogrefe.com/us/shop/d2-test-of-attention.html#1+1>
- Raspberry, C. N., Lee, S. M., Robin, L., Laris, B. A., Russell, L. A., Coyle, K. K., & Nihiser, A. J. (2011). The association between school-based physical activity, including physical education,



and academic performance: A systematic review of the literature. *Preventive Medicine*, 52, S10–S20. <https://doi.org/10.1016/j.ypmed.2011.01.027>

Resaland GK, Moe VF, Bartholomew JB, Andersen LB, McKay HA, Anderssen SA, Aadland E., (2018). Gender-specific effects of physical activity on children's academic performance: The Active Smarter Kids cluster randomized controlled trial. *Prev Med*, 106. 171-176. doi: 10.1016/j.ypmed.2017.10.034

Rosen, P. (2021). Attention: How it's different from working memory. *Understood*.

<https://www.understood.org/articles/en/attention-how-its-different-from-working-memory>

Santana, C. C. A., Azevedo, L. B., Cattuzzo, M. T., Hill, J. O., Andrade, L. P., & Prado, W. L. (2017). Physical fitness and academic performance in youth: A systematic review. *Scandinavian Journal of Medicine & Science in Sports*, 27(6), 579–603.

The Nation's Report Card. (2019). 2019 Reading State Snapshot Report: North Carolina, 4<sup>th</sup> Grade Public Schools. *National Center for Education Statistics*.

<https://nces.ed.gov/nationsreportcard/subject/publications/stt2019/pdf/2020014NC4.pdf>

Theodoratou, M., Kalaftis, D., Panitsa, G. (2020). The Impact of Physical Activity on Mental Health and Psychological Well-Being, Perspectives on Improving the Educational Curriculum. *Journal of Psychology and Neuroscience*, 2(2), 9.

Tine, M. (2014). Acute aerobic exercise: An intervention for the selective visual attention and reading comprehension of low-income adolescents. *Frontiers in Psychology*, 5.

<https://doi.org/10.3389/fpsyg.2014.00575>

Tremblay, M. S., Inman, J. W., & Willms, J. D. (2000). The Relationship Between Physical Activity, Self-Esteem, and Academic Achievement in 12-Year-Old Children. *Pediatric Exercise Science*, 12(3), 312-321.

Trost, S.G. (2009). Active Education: Physical Education, Physical Activity, and Academic Performance. [Research Brief]. *Active Living Research*.

Wold, H. J. (2019). Reading Fluency and GoNoodle© Brain Breaks Among Elementary-Aged Children. *BYU Scholars Archive*. <https://scholarsarchive.byu.edu/etd/7744>

**Appendix A**  
**Informed Consent Form**

**Western Carolina University**  
**Consent Form to Participate in a Research Study**

**Project Title:** HOW THE PROGRAM “GONOODLE” IMPACTS ATTENTION IN ELEMENTARY-AGE CHILDREN

**This study is being conducted by:** Shelby Clark – Specialist in School Psychology Graduate Student  
Candace Boan-Lenzo – Faculty Advisor

**Description and Purpose of the Research:** Your child is invited to participate in a research study about how participating in “GoNoodle” activities affects attention in elementary aged children. By doing this study we hope to learn how physical activity impacts attention and determine if it improves attention.

**What you will be asked to do:** Your student will be asked to participate in 10 minutes of physical activity. They will follow along to a video on the “GoNoodle” website that is fun and engaging. The types of activities that the class will be able to choose from include workout videos, guided dance and indoor recess. Examples of different things they will be asked to do include dynamic stretching, jumping jacks, running in place, and dancing. This will take place in their classrooms. After the students participate in the physical activity, they will then engage in a task that measures their attention. As their parent, you will be asked to fill out this consent form, giving your student permission to participate in the activity. Additionally, you will be asked to fill out a demographic survey that asks questions about your child’s age, gender and ethnicity, as well as your household income and level of education.

**Risks and Discomforts:** We anticipate that your child’s participation in this research presents no greater risk than everyday physical activity. To ensure that the 4<sup>th</sup> and 5<sup>th</sup> grade students are safe throughout this process, researchers and teachers will be in the room monitoring the students engaging in the physical activity. Students will be spread out across their classroom to ensure there is enough space to move around and prevent any injuries that could occur from accidentally bumping into each other.

**Benefits:** There are no direct benefits to you for participating in this research study; however, your student may potentially benefit from physical activity and improved attention. The study may help us better understand how physical activity impacts attention.

**Privacy/Confidentiality/Data Security:** The data collected in this study are anonymous. This means that not even the research team can match you to your data.

**Voluntary Participation:** Participation is voluntary, and you have the right to withdraw your consent or discontinue your child's participation at any time without penalty. If you choose not to allow your student to participate or decide to withdraw, there will be no impact on your student's grades.

**Contact Information:** For questions about this study, please contact Shelby Clark at [slclark7@catamount.wcu.edu](mailto:slclark7@catamount.wcu.edu). You may also contact Dr. Candace Boan-Lenzo the principal investigator and faculty advisor for this project, at [cboan@email.wcu.edu](mailto:cboan@email.wcu.edu).

**If you have questions or concerns about your treatment as a participant in this study, you may contact the Western Carolina University Institutional Review Board through the Office of Research Administration by calling 828-227-7212 or emailing [irb@wcu.edu](mailto:irb@wcu.edu). All reports or correspondence will be kept confidential to the extent possible.**

**You will be given a copy of this information to keep for your records.**

My signature below indicates that I give consent for both my child, \_\_\_\_\_, to participate in this study as well as myself to participate. I understand what is expected of my child and that his/her participation is voluntary.

Parent/Guardian Name (printed): \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

## Appendix B

### Parent/Child Demographic Survey

|  |                       |                 |                        |                   |                        |           |
|--|-----------------------|-----------------|------------------------|-------------------|------------------------|-----------|
| What is your child's age?              | 8                     | 9               | 10                     | 11                | 12                     |           |
| What is your child's gender?           | Male                  | Female          | Other                  |                   |                        |           |
| What is your child's ethnicity?        | White/Caucasian       | Hispanic/Latino | Black/African American | Native American   | Asian/Pacific Islander | Other     |
| What is your household income?         | Below \$10k           | \$10k-\$50k     | \$50k-\$100k           | \$100k-\$150k     | Over \$150k            |           |
| What is the parent level of education? | Less than High School | High School     | Associates Degree      | Bachelor's Degree | Master's Degree        | Doctorate |

## Appendix C

### Tables

#### Table C1

##### Table 1

##### *Means and standard deviations (TN)*

| Group                                   | Pre-Intervention Mean<br>(SD) | Post-Intervention Mean<br>(SD) |
|---|-------------------------------|--------------------------------|
| Physical Activity Video Group (Control) | 104.8 (1.7)                   | 115.1 (2.0)                    |
| GoNoodle Group                          | 102.4 (1.8)                   | 113.6 (2.1)                    |

#### Table C2

##### Table 2

##### *Means and standard deviations*

| Group                                   | Pre-Intervention Mean<br>(SD) | Post-Intervention Mean<br>(SD) |
|---|-------------------------------|--------------------------------|
| Physical Activity Video Group (Control) | 101.4 (39.1)                  | 128.8 (46.2)                   |
| GoNoodle Group                          | 111.5 (24.3)                  | 137.1 (27.6)                   |

#### Table C3

##### Table 3

##### *Means and standard deviations*

| Group                                   | Pre-Intervention Mean<br>(SD) | Post-Intervention Mean<br>(SD) |
|---|-------------------------------|--------------------------------|
| Physical Activity Video Group (Control) | 106.47 (11.6)                 | 115.0 (11.0)                   |
| GoNoodle Group                          | 100.6 (7.5)                   | 109.7 (10.0)                   |