Impact of the Teaching HENRY (Healthy Exercise and Nutrition Recommendations for Youth) Intervention on Physical Activity Knowledge and Behavior in Rural Appalachia

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This thesis titled
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Abstract
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Introduction: Storybook characters may provide young children with a role
model for healthy behaviors and improve their understanding of recommendations for
daily physical activity (PA) and sedentary behavior (SB). Purpose: To assess the effect
of a character-based intervention on children’s knowledge of recommendations, benefits,
and definitions of PA and SB and participation in these behaviors. Methods: All children
(6-11 y, N = 21) in an after-school program completed a questionnaire on knowledge,
self-efficacy, and habits at pre- and postintervention. A consented subset (n = 6)
completed anthropometric measures at baseline and wore an accelerometer for 7 days at
both time-points to objectively determine PA. A repeated measures ANOVA assessed
changes in knowledge, self-efficacy and behavior from pre- to postintervention by sex,
consent status, and program-determined team (based on grade) (p < 0.05). Results:
Knowledge increased 14.3% points (p < 0.01) and self-efficacy increased 22.5% points (p
= 0.01). Measured PA increased by 7 min/day (p = 0.41), while SB decreased 21 min/day
(p = 0.62) and self-reported screen-time decreased by 1.5 hr/day (p = 0.39). Conclusion:
This character-based intervention promoted positive changes in knowledge and self-
efficacy, with practically important changes in behavior in rural Appalachian youth.
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Chapter 1: Introduction

The latest National Health and Nutrition Examination Study (NHANES) found that 17% of children (6-11 years of age) were obese (OB) and 33% were overweight (OW) (Ogden, Carroll, & Flegal, 2008). Incidence of obesity was found to be 3-5% higher in rural Appalachia, where low socioeconomic status (SES) and inadequate health education may be mediating factors (Montgomery-Reagan, Bianco, Heh, Rettos, & Huston, 2009). Obese children have a 70% chance of becoming OB adults, so prevention of unhealthy weight gains in child populations is crucial to the prevention of widespread obesity and the social, economic, and health concerns it perpetuates (Roger et al., 2012). Obesity is related to a chronic energy intake greater than that needed for healthy growth and development, which has been attributed to poor diet, inadequate physical activity (PA), and excess sedentary behavior (SB) (Butte, Christianson, & Sorensen, 2007).

To prevent negative health consequences, evidence-based recommendations for PA and SB have been established. Children should participate in at least 60 min/day of moderate-to-vigorous physical activity (MVPA) and no more than 2 hr/day of screen-time SB (American Academy of Pediatrics, 2013; U.S. Department of Health and Human Services [USDHHS], 2008). However, the majority of children are unaware of the duration, frequency, or intensity of recommended PA and less than half of children, 6-11 years of age, meet this recommendation (Epstein et al., 2001; Roberts & Marvin, 2011; Troiano et al., 2008). Similarly, 73% of children exceed the recommendation for screen-time SB and knowledge of the recommendations and consequences of screen-time is lacking (Herrick, Fakhouri, Carlson, & Fulton, 2014; Jordan, Hersey, McDivitt, & Heitzler, 2006).
Poor adherence to these guidelines has been associated with children’s lack of knowledge of recommendations and outcomes (benefits, consequences) of these behaviors, but research in this area is still needed (Sallis, Prochaska, & Taylor, 2000). Due to this potential relationship between knowledge and behavior, it is proposed that an education-based intervention focused on recommendations and the associated outcomes could result in more children meeting daily activity goals. Unfortunately, health education is often postponed to adolescence due to the difficulty of educating young children, when intervention is key to develop lifelong healthy habits.

Although previous interventions focused less on education, they had modest success in decreasing SB (van Sluijs, McMinn, & Griffin, 2008) or increasing MVPA participation (Scruggs, Beveridge, & Watson, 2003). However, many of these studies controlled the amount of SB and simply assessed changes in other variables (e.g., dietary intake, PA) or provided children with more opportunities to participate in MVPA. But, once the intervention was over, the effects did not persist. For example, Gutin et al. (1999) demonstrated that while body fat and metabolic factors (e.g., plasma insulin) were significantly improved following a 4-month structured PA intervention (40 min, 5 days/week), levels returned to baseline 4 months after the intervention ended. Instead, teaching children why we want them to be active, how long they should be active, and the benefits of adequate PA and consequences of excess SB may encourage them to adopt healthy habits that persist after the intervention stimulus is removed.

Educating children on the benefits of PA, the consequences of SB, and recommendations for duration, intensity, and frequency may be difficult due to children’s lack of familiarity with the terminology. Accounting for the unique characteristics of this
population, such as how they learn, could make interventions more successful. Research suggests that children’s literature promotes acceptance of new ideas and behaviors, but little research has been conducted on health behaviors in children (Campbell & Wirtenberg, 1980). For example, de Droog, Buijzen, and Valkenburg (2014) found significantly higher levels of carrot consumption in groups of children (4-6 years of age) who read a storybook promoting carrots as a healthy food that makes you feel “fit and strong” as compared to control groups (no storybook). While positive effects were seen on one specific behavior (carrot consumption) in the short-term, research on the use of a health-promoting storybook over several weeks for a more holistic realm of behaviors, to include PA, is warranted. The children’s book Henry Gets Moving! uses a likeable and relatable hamster, Henry, to teach children about the importance of both being active and eating healthy. Thus, it may be a suitable tool on which to base an age-appropriate, healthy lifestyle intervention that leads to increased participation in healthy behaviors.

**Statement of Purpose**

To assess the effect of a 6-week character-based healthy lifestyle intervention on PA knowledge and behaviors in first to fourth grade Appalachian children. See Table 1 for individual specific aims and hypotheses.
Table 1

Specific Aims (A) with Corresponding Methods (M) and Hypotheses (H)

**A1:** To assess the impact of the 6-week healthy lifestyle intervention based on a children’s storybook on knowledge of the outcomes (benefits, consequences), recommendations (frequency, duration, intensity), and definitions of PA and SB.

**M1:** All children will complete a questionnaire on their understanding and knowledge of PA outcomes, definitions and recommendations, before and after the intervention.

**H1:** Children’s knowledge of healthy PA recommendations, benefits, and definitions will be significantly improved from baseline after the intervention.

**A2:** To assess the impact of the 6-week healthy lifestyle intervention based on a children’s storybook on the average amount of time per day spent in MVPA and SB.

**M2:** A subset of children will wear an Actigraph GT3X+ monitor (Pensacola, FL) for 7 days before and after the intervention to assess daily MVPA and SB.

**H2:** Daily minutes of MVPA will increase and SB will decrease from baseline after the intervention.

**A3:** To assess the relationship between children’s knowledge of recommended PA behaviors and associated health outcomes and participation in both PA and SB.

**M3:** The correlation between differences (score after intervention - before intervention) in knowledge and differences in self-reported PA and SB will be assessed.

**H3:** There will be a significant, positive relationship between changes in knowledge and reported PA participation and a significant, negative relationship between changes in knowledge and reported daily SB participation.

**Definition of Terms**

**Accelerometer.** A small device that measures duration and pattern of movement by detecting accelerations as gravitational force (g), filtering out nonhuman movement, and summing the data over a specified epoch (e.g., 1 s) to convert units to “counts.” These data are compared to established age-appropriate cut-points to determine activity intensity.
**Appalachia.** A North American region following the Appalachian mountains, encompassing portions of Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia, and all of West Virginia (Ickes & Slagle, 2013).

**Body mass index (BMI).** An indirect indication of body composition, defined as body mass (kg) divided by height (m) squared (Kuczmarski et al., 2000). For children, BMI values are compared to Centers for Disease Control and Prevention (CDC) age- and sex-specific charts to determine BMI percentiles (Kuczmarski et al., 2000).

**Healthy weight (HW).** A BMI < 85th percentile.

**Moderate-to-vigorous physical activity (MVPA).** Physical activity intense enough to elicit energy expenditure ≥ 3 metabolic equivalents (METs; 1 MET = rest) (Ridley, Ainsworth, & Olds, 2008). In children, this may be described as: “activity that makes your heart beat fast and you breathe harder; if you think of a 10-point scale where 1 is laying in bed and 10 is the hardest thing you have ever done, it would be a 5 or 6.”

**Obese (OB).** A BMI ≥ 95th percentile.

**Overweight (OW).** A BMI ≥ 85th but < 95th percentile.

**Physical activity (PA).** Any bodily movement by contraction of skeletal muscle that increases energy expenditure above resting values.

**Rural.** According the United States Census Bureau, a rural area is any area that is not urban; urban areas must have at least 2,500 people (Health Resources and Services Administration, n.d.).

**Sedentary behavior (SB).** Activity that results in energy expenditure ≤ 1.5 METs. Example activities include sitting, lying down, etc. (Ridley et al., 2008).
Social cognitive theory (SCT). A social and behavioral theory that describes a reciprocal relationship between personal factors, the environment, and behavior (Bandura, 1998).

Socioeconomic status (SES). Measure of an individual or household’s economic and social position, to include income, education, and occupation.

Waist circumference (WC). An indicator of abdominal obesity and increased risk for metabolic and cardiovascular disease that is measured with a Gulick tape measurer along a horizontal plane at the level of the suprailiac crest.

Assumptions

The assumption is made that all participants and their parents will complete questionnaires to the full extent of their knowledge and ability. It is also assumed that all children will be in attendance at all lessons, pay attention to the lesson content, and will complete all take-home activities. It is assumed that any increase in knowledge and changes in behavior will be due to the intervention, not outside education.

Limitations

The small sample size and lack of a control school are limitations of this study.

Delimitations

All participants are in first to fourth grade and participating in a preexisting after-school program aimed at underserved, at-risk youth in rural Appalachia.
Chapter 2: Review of Literature

Childhood obesity is a major public health concern due to an increase in prevalence over the last several decades coupled with a growing body of research on the associated negative consequences. Childhood obesity leads to increased risk for cardiovascular and metabolic conditions, such as type 2 diabetes mellitus and atherosclerosis, conditions traditionally thought to be confined to adulthood (Adebayo & Willis, 2014; Berenson & Srnivasan, 2005; Biro & Wien, 2010; Franks et al., 2010). Development of obesity has been linked to an energy surplus caused by poor diet, inadequate PA, and excess SB (Butte et al., 2007; Hill, 1998). In an effort to prevent obesity and its comorbidities, recommendations for healthy diet and activity have been published, but poor diet, lack of PA, and excess SB are still prevalent in children (Graf et al., 2004; Matthews et al., 2008; Troiano et al., 2008).

Prior interventions focused on increasing MVPA or decreasing SB, but little focus has been on education. In addition, intervention protocol designs, measureable outcomes, and results are inconsistent (Stice, Shaw, & Marti, 2006; van Sluijs et al., 2008). Use of children’s literature is a novel area of research and may increase knowledge of the recommendations and associated benefits of healthy activity choices and subsequently increase children’s participation in recommended health behaviors. In this review, obesity, associated negative outcomes, and the role of adequate PA and minimal SB will be discussed. Finally, novel strategies to promote healthy lifestyles in children, such as education through use of child-friendly characters, and future directions will be explored.
**Childhood Obesity**

Childhood obesity is a recognized pandemic and incidence has tripled over the last three decades (Ogden et al., 2008; Ogden, Flegal, Carroll, & Johnson, 2002). Nationally, 33% of children, age 6-11 years of age, are OW, while 17% of children are OB (Ogden et al., 2008). Obesity begets many comorbidities, which can be metabolic, psychological, cardiovascular, respiratory, and skeletal in nature. Childhood obesity has been shown to track into adulthood and furthermore, increased incidence of metabolic and cardiovascular disease risk factors are seen even in children who transition to a healthy weight in adulthood (Biro & Wien, 2010; Serdula et al., 1993; Whitaker, Wright, Pepe, Seidel, & Dietz, 1997).

**Definitions and measurements.** Obesity is commonly measured using Body Mass Index (BMI), which is defined as body mass (kg) divided by height in meters squared (kg/m$^2$). Due to the varying growth rates of children and differences between genders, the Centers for Disease Control and Prevention (CDC) generated age- and sex-specific growth charts. Relative to these charts, OW is defined as a BMI of $\geq 85^{th}$ but $< 95^{th}$ percentile and OB as a BMI of $\geq 95^{th}$ percentile (Ogden et al., 2002). Research has established BMI to be a valid measure of body fatness if corrected for age and gender and is frequently used due to its low cost and ease of measurement (Pietrobelli et al., 1998).

Since BMI cannot indicate body fat distribution (namely, central or abdominal obesity); measurement of waist circumference (WC) can provide important additional information. Waist circumference is highly correlated with metabolic disease risk in children and adults, and has been shown to have a stronger correlation with insulin resistance, blood pressure, and dyslipidemia than BMI or dual-energy x-ray
absorptiometry (DEXA) measured body fat percentage (Krebs et al., 2007; Linne, & Rossner, 2005; Neovius, Stevens, 1995). Both BMI and WC are valid indicators of obesity, are practical and inexpensive, and, thus, are ideal for use in child populations and school settings.

**Comorbidities and consequences.** Childhood obesity is linked to a vast number of complications, including type 2 diabetes, metabolic syndrome, depression, obstructive sleep apnea, nonalcoholic fatty liver disease, as well as various other comorbidities (Berenson & Srnivasan, 2005; Cornette, 2008; Daniels et al., 2005). Many of these complications are becoming more frequent in children as obesity rates rise and a clear shift in age of onset has been demonstrated (Adebayo & Willis, 2014; Kurtz, Peckham, & Ades, 1988). Obese children have exhibited increased insulin resistance and impaired lipid profiles compared to their nonobese counterparts, as well as increased expression of inflammatory markers (hsCRP, IL-6, TNF-α, etc.), which could indicate increased risk for atherosclerosis (Kim et al., 2010; Rentfro et al., 2011). These findings are in agreement with previous research that found OW children have a 60% chance of developing risk factors, such as hypertension, hyperinsulinemia, and hyperlipidemia, by age 10 (Berenson & Srnivasan, 2005). Additionally, it was found that 17% of OB boys suffered from sleep apnea, a condition significantly related to central adiposity and overall fat mass. Research has shown that OW children, 2-17 years of age, also suffer from significantly more lower-extremity injuries, particularly at the ankle and foot (Krul, van der Wouden, Schellevis, van Suijlekom-Smit, & Koes, 2009).

Complications of childhood obesity do not just manifest themselves physically. Childhood OW can lead to psychosocial complications such as depression, anxiety, and
overall decreased quality of life (Schwimmer, Burwinkle, & Varni, 2003). In a study by Schwimmer et al. (2003), it was found that OB children, 5-18 y, had a quality of life similar to children diagnosed with cancer and quality of life was even lower for children who suffered from obesity-related health problems, such as sleep apnea. In a review by Cornette (2008) of the emotional influence of childhood obesity, every participant reported a negative psychosocial outcome from being OW (e.g., depression, low self-esteem, poor quality of life, or behavioral issues). Girls and younger participants were more susceptible to emotional impact based on weight status. These findings highlight the importance of preventing childhood obesity for the sake of a child’s physiological health, mental well-being, and future health status, especially in girls and younger children.

**Tracking into adulthood.** Research has demonstrated that the consequences associated with childhood weight status are not confined to the childhood years. Longitudinal studies have shown that weight status tracks into adulthood, with 70% of OW children becoming OW adults (Biro & Wien, 2010; Franks et al., 2010; Must, Jacques, Dallal, Bajema, & Dietz, 1992; Roger et al., 2012; Serdula et al., 1993; Whitaker et al., 1997). Additionally, children were more likely to become OB adults if their parents were OB. Risk for adult obesity was shown to be three times greater if an OB child (6-9 years of age) had one OB parent, or five times greater if the child has two OB parents (Whitaker et al., 1997). Furthermore, childhood obesity can lead to an increased risk of stroke, cardiovascular disease, osteoporosis, type 2 diabetes, or a number of other conditions in adulthood (Berenson & Srinivasan, 2005; Must et al., 1992). Must et al. (1992) found that adolescent weight status was a more powerful, and independent,
predictor of an individual’s risk for morbidity from coronary heart disease than weight status in adulthood. So, OW children are more likely to become OW adults, but the negative consequences resulting from childhood obesity track into adulthood independent of adult weight status. Since it is crucial that these negative consequences of obesity be avoided, it is important to understand obesity trends, causes, and prevention strategies.

**Obesity in rural Appalachia.** A relationship between childhood obesity and residential location, such as rural Appalachia, has been proposed in the literature. Although the term “Appalachia” refers to a diverse and large region that encompasses portions of 13 states, the area is more rural than the national average (42% vs. 20%) (Ickes & Slagle, 2013). For the purpose of this review, “Appalachia” will be used solely in reference to the rural portions of the region. Although research has shown children living in the Appalachian region are highly susceptible to obesity, lack of PA, and poor diet, delineating the basis of these negative trends is difficult.

In Appalachian Ohio counties, 40-49% of children were OW, as compared to 34.7% in other Ohio counties (Oza-Frank, Norton, Scarpitti, Wapner, & Conrey, 2011). Furthermore, Lutfiyya, Lipsky, Wisdom-Behounek, and Inpanbutr-Martinkus (2007) found that OW children were 25% more likely to live in a rural area than in an urban area, while others reported that rural obesity rates were 2% greater than their urban counterparts (Demerath et al., 2003; Liu, Bennett, Harun, & Probst, 2008; Patterson, Moore, Probst, & Shinogle, 2004). As reported by Montgomery-Reagan et al. (2009), 17% of Appalachian children, 6-11 years old, were OB, as compared to 15.6% nationwide (data from NHANES 2003 - 2006) (Montgomery-Reagan et al., 2009). Other studies in similar Appalachian communities found obesity rates as high as 27%, coupled
with blood pressure values and blood lipid profiles above the national average (Demerath et al., 2003).

It has been suggested that these increased rates of OW and obesity may be due in part to unique challenges faced by the Appalachian region, such as socioeconomic disadvantage, lack of nutritional education, inadequate health insurance, geographic isolation, unavailability of healthy food (food deserts) or sidewalks, and many other mediating factors (Reed, Patterson, & Wasserman, 2011). Socioeconomic status is one of the largest contributing factors to these high rates of obesity and OW in Appalachian children (Liu et al., 2008). A study of child (10-17 years of age) obesity incidence as compared to household poverty status (ratio of family income to poverty threshold) found that as poverty status worsened, prevalence of obesity increased. Those in the <100% category (e.g., income was less than poverty threshold) were 22% obese, as compared to 9% in the group with the highest income-to-poverty threshold ratio (Singh, Kogan, & van Dyck, 2008). Due to this relationship between low socioeconomic status and unhealthy weight status, it is important to note that Athens County, OH is one of the poorest counties in the nation with 31.5% of the population living under the poverty level, as compared to the statewide average of 14.8% (U.S. Census Bureau, 2013). Furthermore, according to the Appalachian Regional Commission, Athens County is one of 93 counties labeled as “distressed,” defined as the most economically depressed and ranking in the worst 10% nationwide (Appalachian Regional Commission, 2014). Therefore, this area may be of particular interest for health intervention.

To further understand mediating factors of childhood obesity in Appalachia, a series of focus groups were conducted by Swanson, Schoenberg, Erwin, and Davis
(2013) and found that Appalachian youth had negative feelings towards “exercise.” The long distance to parks, unavailability of sidewalks, cost of PA participation, and lack of knowledge were cited as barriers to being physically active. This lack of knowledge may have the potential to improve with an education-based intervention aiming to increase knowledge about the benefits and recommendations for PA duration and intensity. Educational interventions for children in this region should have the goal of demystifying PA to negate these perceived barriers, by distinguishing PA from “exercise” and encouraging an overall healthy lifestyle with the hallmark of choosing activity over inactivity.

**Causes of Childhood Obesity**

Although parental weight status, socioeconomic disadvantage, and rural habitation are influencing factors, these are not the root cause of childhood OW. Chronic energy surplus above that needed for healthy growth and development has been deemed the fundamental cause of obesity. To combat the energy surplus associated with childhood obesity, considerable research has been done to develop sound recommendations for PA and SB in children. A study by Laurson et al. (2008) found that children who did not meet PA or screen-time guidelines were three to four times more likely to be overweight than children who adhered to both guidelines. Unfortunately, most youth do not attain the recommended amount of MVPA and acquire more than the recommended amount of SB.

**Energy surplus.** Obesity is related to the balance between energy intake and energy expenditure. If energy intake is equal to energy expended, there is a neutral energy balance and bodyweight is maintained. However, if energy intake exceeds energy
expenditure, there is a surplus of energy and bodyweight increases over time. Contrary, if energy expenditure exceeds energy intake, body weight will decrease over time (Butte et al., 2007). Since children are expected to grow during childhood, they require a positive energy balance, or a surplus of energy. It is the excess surplus beyond that needed for normal growth and development that leads to obesity. The excess energy surplus associated with childhood obesity has been reported as an average of 100 kcal/day in 2-17-year-old youth or from 14 kcal/day in 2-7-year-olds, 97 kcal/day in 5-7-year-olds and as much as 250 kcal/day in 12-17-year-olds (Butte et al., 2007; Wang, Gortmaker, Sobol, & Kuntz, 2006).

**Sedentary behavior.** Research suggests that SB leads to positive energy balance and unhealthy weight gain through inadequate PA and increased dietary intake. Furthermore, screen-time SB is associated with many negative health consequences beyond obesity and recommendations for limiting screen-time are just now becoming widespread. There is an important distinction between positive SB, such as homework or reading, and negative SB, particularly screen-time activities. For the purpose of this review, SB will primarily refer to screen-time activities unless otherwise noted.

**Association with weight status.** Research on the relationship between SB and unfavorable weight status is increasingly popular and computer usage, TV watching, and total hours of overall SB have been significantly related with weight status in children (Arluk, Branch, Swain, & Dowling, 2003). Anderson, Economos, and Must (2008) found that OW children, 4-11 years of age, were more likely to participate in greater than 2 hr of screen time a day (70.9%) compared to HW children (64.3%). Other studies have aimed to elucidate what specific types of screen time may be related with obesity, but
results so far are unclear (Carvalhal, Padez, Moreira, & Rosado, 2007; Kozey-Keadle, Libertine, Lyden, Staudenmayer, & Freedson, 2011; Oliver, Schluter, Rush, Schofield, & Paterson, 2011; Vandewater, Shim, & Caplovitz, 2004). TV time was greater than 30% higher, while video games and computer use were three times higher in OB children (Graf et al., 2004). However, Oliver et al. (2011) found no relationship between computer use or number of TV hours and weight status, but a relationship between number of days per week watching TV was positively associated with weight (Oliver et al., 2011). Another study found that although TV use was not associated with weight, video game time and overall SB time (including screen-free SB) were associated with weight status (Yen et al., 2010). Results may also vary by gender, as shown by Carvalhal et al. (2007), who found a significant relationship between hours of TV watching and BMI only in boys.

**Consequences.** Sedentary behavior contributes to the positive energy balance associated with obesity by supporting decreased PA participation (replacement of PA with SB) and increased consumption of unhealthy foods (“junk” foods) (Epstein, Paluch, Consalvi, Riordan, & Scholl, 2002; Epstein, Roemmich, Paluch, & Raynor, 2005). Screen-time has been associated with increased risk for metabolic syndrome in a dose-response relationship independent of PA (Mark & Janssen, 2008). Interestingly, increased TV viewing during adolescence has also been associated with unfavorable outcomes in young adulthood, such as high triglycerides and adiposity (Grontved et al., 2014).

In addition to risk for unfavorable weight status, SB may lead to other problems. For example, increased computer usage may lead to eye strain, blurred vision, or tired eyes (Blehm, Vishnu, Khattak, Mitra, & Yee, 2005). A relationship between early (1-3
years of age) TV exposure and attention problems in childhood (7 years of age) has also been demonstrated (Christakis, Zimmerman, DiGiuseppe, & McCarty, 2004). In a study by Li et al. (2007), increased TV watching was associated with significantly longer sleep onset delay and higher rates of sleep anxiety and sleep duration disorders in children, age 9 years old. A study by Hakala, Rimpelä, Saarni, and Salminen (2006) found that 26% of 14-18-year-olds had neck-shoulder pain and that there was a positive association with hours of computer use, particularly if use exceeded 2 hr a day.

**Prevalence.** The American Academy of Pediatrics recommends that children over two years of age engage in no more than 2 hr a day of screen time, including TV, phones, and computers (American Academy of Pediatrics, 2013). Data from the 2012 NHANES indicated that only 27% of youth aged 12-15 years participated in less than 2 hr of TV and computer use daily (Herrick et al., 2014). Janssen et al. (2005) found that of the over 4000 subjects (10-16 years of age) in the United States, 47% said they watched more than 3 hr of TV on an average week day and rates were even higher on weekends. Other research has reported a wide range of daily SB in youth. Christakis, Ebel, Rivara, and Zimmerman (2004) demonstrated that children aged < 11 years old engaged in 1.5 hr of TV, 1.1 hr of video, and 0.5 hr of computer games per day. However, Rideout et al. (2010) found that across the United States, children 8-18 years of age engaged in 7.5 hr of screen time per day (Rideout, Foehr, & Robets, 2010). Further, children with low SES may participate in more SB than children with higher SES (Brodersen, Steptoe, Boniface, & Wardle, 2007). Tandon et al. (2012) demonstrated that low SES children were more likely to have TV (52%), DVD (39%), or video games (21%) in their bedroom compared to higher SES children (TV = 14%, DVD = 14%, video games = 9%). Overall, this study
found that daily screen time was 0.7 hr greater in low SES children than higher SES children.

Additionally, a trend of increasing SB with age was found by Robinson (2001) as children, age 2-7 years old, watched an average of 2.5 hr of TV a day, while children, 8-18 years old, spent 4.5 hr watching TV. This increase in SB with age has been supported by other research, with NHANES demonstrating an increase from 6 hr/day at 6-11 years old to 8 hr/day at 16-19 years old (Matthews et al., 2008). Similarly, Brodersen et al. (2007) demonstrated a decrease in PA and an increase in SB with age. Literature describes the tracking of SB from childhood to adulthood, so formation of healthy habits early in life is critical (Biddle, Pearson, Ross, & Braithwaite, 2010).

**Measures.** While direct observation is the gold standard, SB remains one of the most difficult behaviors to measure because overall, a lot of SB takes place at home (e.g., TV, homework, sleeping) or during school. Self-report is commonly used, but may be skewed due to unawareness of the actual amount of time spent watching TV or playing video games or a reluctance to report the number of hours participating in these behaviors. To enhance self-report, measures of the availability of equipment that supports SB, such as TVs, video game consoles, or computers may be a useful although incomplete indicator of SB. Furthermore, self-report from children can be supported by parent report to improve accuracy.

Objective forms of measurement include accelerometry, but better methodology for their use needs to be developed. Typically the monitor software eliminates periods of time with consecutive zero counts as “nonwear” time, assuming the child is asleep or not wearing the device. A study by Hanggi, Phillips, and Rowlands (2013) found that more
counts were registered by the anteroposterior axis than the vertical axis during SB. This means some SB data may be lost if only data from the vertical axis are being used, but use of triaxial accelerometers may aid in differentiation between nonwear and true SB. A study by Kozy-Keadle et al. (2011) found that the Actigraph GT3X (triaxial accelerometer) was most accurate when using a cut-point of < 150 counts/min for SB as compared to direct observation ($R^2 = 0.4$), while others have supported a cut-point of < 100 counts/min (Freedson, Pober, & Janz, 2005). Some accelerometers, such as the Actigraph GT3X, have incorporated an inclinometer, which is supposed to indicate if the subject is standing, sitting, lying, or if the monitor is not being worn. However, the validity of this function is limited and may be location and activity-dependent (McMahon, Brychta, & Chen, 2010). Hanggi et al. (2013) found that the inclinometer function in the GT3X classified sitting correctly 94% of the time, but only classified nonwear time correctly 45% of the time. Further modifications are constantly made to the Actigraph monitor and ActiLife software, so detection of SB may be more accurate now than demonstrated in previous research. Importantly, this objective measure cannot illustrate whether the SB is a positive behavior (e.g., reading) or a negative behavior (e.g., TV). Further research should elucidate the best weartime parameters and data analysis techniques to lessen the possibility of under- or overreporting SB, while a combination of self-report and objective monitoring may be the best option currently available.

**Physical Activity.** The positive energy balance associated with childhood obesity may be negated in part by adequate PA. Independent of weight status, PA has numerous benefits both physically and mentally (Dentro, 2014). Unfortunately, the majority of youth do not meet the daily recommendations for MVPA (Janssen et al., 2005).
**Benefits.** Research has demonstrated an inverse relationship between PA and BMI, a relationship which strengthens with age (Jago, Baranowski, Baranowski, Thompson, & Greaves, 2005). Janz, Burns, and Levy (2005) found that children with the highest total activity (counts/day) or highest amount of vigorous PA were in the lowest quartile for DEXA-measured percent body fat. The U.S. Department of Health and Human Services (USDHHS) 2008 Physical Activity Guidelines for Americans reported that there was “strong evidence” to support a relationship between PA and improved cardiovascular and muscular fitness, bone health, cardiovascular and metabolic health biomarkers, body composition, and moderate evidence to support a relationship between PA and reduced depression symptoms (USDHHS, 2008). In adulthood, this list expands remarkably to include 23 health benefits of PA, including lower risk of early death. More recently, the 2014 U.S. Report Card on Physical Activity for Children and Youth indicated additional health benefits associated with daily PA, including increased fitness, improvements in motor control, improvements in academic performance, and decreases in risk of cardiovascular disease and type 2 diabetes in both childhood and adulthood (Dentro, 2014).

Regular PA has led to improved insulin sensitivity and decreased inflammatory markers; both dynamics that are disturbed by excess body fat (Pischon, Hankinson, Hotamisligil, Rifai, & Rimm, 2003). In the European Heart Study, PA (via accelerometry) was inversely associated with systolic and diastolic blood pressure, fasting glucose, insulin, and triglycerides, independent of weight status. It is widely accepted that PA (particularly load-bearing or high-impact) during early childhood leads to increased peak bone mass that persists through the years and ultimately may serve as
protection from fragility or osteoporosis later in life (Janz et al., 2010). Additionally, regular PA helps with social development and cognitive function in youth and a study by Tremblay, Inman, and Willms (2000) found that questionnaire-based PA and self-esteem were positively related.

**Prevalence.** The USDHHS published the Physical Activity Guidelines for Americans which recommend children attain at least 60 min/day of MVPA (USDHHS, 2008). This activity should be age appropriate and include vigorous intensity PA, bone strengthening, and muscle strengthening activities at least three days a week each. Some examples of age-appropriate activities include jump rope, climbing monkey bars, and team sports. Due to the intermittent nature of children’s activity patterns, the recommended dosage of PA is additive, meaning any length of MVPA can contribute to the daily-recommended dosage. The Health Behavior in School-Aged Children Study surveyed 10-15-year-olds in 34 countries and found that less than half of youth achieved the recommended amount of PA (Janssen et al., 2005). The 2014 U.S. Report Card on Physical Activity for Children and Youth was written by a committee of professionals that determined data sources representative of the U.S. population and gave “grades” for different indicators. Importantly, the United States received a “D-” for overall PA and it was reported that only 42% of children (6-11 years of age) met the recommendation of 60 min of MVPA at least 5 days a week (data from NHANES 2003-2004). Interestingly, an average of 88 min/day of MVPA was also reported for children of this age (data from NHANES 2003-2006) (Dentro, 2014). This highlights the interday variability in PA attainment by youth, who may be highly active some days, but still not meet the 60 min recommendation every day of the week.
Research suggests there may be differences in PA attainment by gender, race, or SES. Some research implicates low PA in minority and underserved populations, which may be attributed to environmental correlates, such as low availability of recreational facilities in disadvantaged areas (Gordon-Larsen, Nelson, Page, & Popkin, 2006; Moore, Diez Roux, Evenson, McGinn, & Brines, 2008). Many studies support greater PA in boys than girls, which is often attributed to a difference in activity preference (Belcher et al., 2010; Guinhouya, Hubert, Dupont, & Durocher, 2005). According to direct observation studies, boys typically participate in more sports and games involving larger groups, while girls tend to participate in more one-on-one social interactions and sedentary activities (Saint-Maurice, Welk, Silva, Siahpush, & Huberty, 2011; Woods, Graber, & Daum, 2012).

A trend of declining PA with age has also been established (Ridgers, Saint-Maurice, Welk, Siahpush, & Huberty, 2011). NHANES (2003-2004) found that 48.9% of males and 34.7% of females, 6-11 years of age, attained the daily-recommended dosage of 60 min of MVPA every day ($M = 88$ min/day) (Troiano et al., 2008). In contrast, only 11.9% of males and 3.4% of females, 12-15 years of age, met the recommended dosage of 60 min of MVPA every day ($M = 33$ min/day) (Belcher et al., 2010). This trend of declining PA with age coupled with evidence of PA habits tracking from adolescence to young adulthood support the importance of developing healthy habits early in life (Kelder, Perry, Klepp, & Lytle, 1994; Raitakari et al., 1994).

**Measures.** The criterion measure of PA in children is direct observation, in which trained research staff scans an area and records the overall PA level on a premade recording sheet/system. Researchers alternate between intervals of observing and
recording, for example 10 s observation followed by 10 s of recording. Some systems may record data by individual, but most are designed to assess overall group PA levels. The disadvantages of this system are clear, as research staff training and stamina are critical to accurate results and energy expenditure can not be objectively measured. Furthermore, the number of observed children and the number of scans possible in a certain amount of time leave room for missing data and an inaccurate representation of PA patterns. For these reasons, many researchers have moved towards use of objective monitors, such as accelerometers, to measure PA in children.

Triaxial accelerometers measure acceleration from 0.05 to 2.5 g in three planes (vertical, anteroposterior, and mediolateral) and then sum this data over a specified epoch (count) (Chen & Basset, 2005). The counts are then compared to various established cut-points in counts/min to determine activity intensity. For example, Mattocks et al. (2007) developed cut-points for children (SB = < 100 counts/min, light PA = 101-3580 counts/min, moderate PA = 3581-6129 counts/min, vigorous PA = > 6130 counts/min) after children performed a series of activities, like sitting and hopscotch. The lightweight monitors can be worn 24 hr a day, which provides a larger picture of PA levels. However, monitor placement and user compliance may affect results, so careful instruction must be given.

**Lifestyle Interventions**

Interventions in youth have focused primarily on increasing daily MVPA by increasing school-time PA. These interventions have shown low to moderate success in increasing children’s MVPA, as a review of controlled PA-promoting interventions found that only 47% saw a significant positive intervention effect (van Sluijs et al., 2008).
Interventions aiming to decrease SB are rising in popularity and have shown similar success rates (Epstein et al., 1995; Epstein et al., 2002; Howe, Freedson, Alhassan, Feldman, & Osganian, 2012; Scruggs et al., 2003, 2003; van Sluijs et al., 2008). However, many of these protocols directly modify the amount of MVPA or SB participation by providing PA opportunities (e.g., additional structured physical education class) or strictly control the dosage of SB or MVPA to test for effects on other variables. For this reason, behavior outside of the intervention setting is often unaltered and it is difficult to elucidate if the interventions would have a long-term effect on any behavioral changes. Intervention success may be moderated by design factors, such as length, target age group, and use of theory-based constructs.

**Previous interventions.** Historically, interventions have provided additional time for PA by extending recess or adding activity breaks throughout the school day, so an increase in daily PA attainment is expected (Guinhouya et al., 2005). Likewise, interventions that provide structured activities or games that are known to be of moderate-to-vigorous intensity see increases in MVPA attainment (Howe et al., 2012), as do interventions that provide children with additional equipment (Verstraete, Cardon, Clercq, & Bourdeaudhuij, 2006). Although any increase in MVPA is encouraging, these results do not indicate a lasting change in behavior outside of the intervention setting. Lanigan (2011) described young children’s lack of knowledge of what activities were good for their health and their inability to identify why they should participate in healthy activities. This study concluded that future interventions should aim to improve PA knowledge first, providing children the rationale for healthy lifestyle choices so they can identify and then choose to participate in healthy activities.
Most interventions with an education component actually refer to physical education, namely demonstrating skills such as running or skipping, and not education on the benefits of PA or consequences of inactivity. An intervention by Ling, King, Speck, Kim, and Wu (2014) aimed to use “health education” to increase the number of children who met the recommendations for healthy diet and PA. Although this intervention demonstrated an increase from 1% of the participants meeting PA goals to 5% (measured by pedometer), it did not include the recommended amount or the benefit of daily MVPA as learning objectives. Similarly, Harrel et al. (1996) improved “health knowledge” by almost 8% following an 8-week intervention that included education on nutrition and smoking, but only exercise sessions instead of education about PA.

Interventions for SB often involve controlling the amount of SB and testing for an effect on other variables, such as adiposity, disease risk, dietary intake, or daily PA levels. For example, a study by Epstein et al. (2005) utilized a within-subject crossover design to test the effect of increasing SB by 25-50% and decreasing SB by 25-50% as compared to baseline SB. The results of this study indicated that decreasing SB results in decreased energy intake and increased PA participation. Another study by Epstein et al. (1995) randomized OW children (8-12 years of age) in to one of three groups: a) reinforcing decreased SB, b) reinforcing increased PA, or c) combined. Reinforcement included using praise to increase desired behavior and setting goals of either increasing or decreasing certain behaviors, with weekly prizes given as motivation. This study found that reinforcing decreased SB resulted in lower reported caloric intake, increased PA participation and liking, and greater decreases in body fat and percentage of children OW. Interestingly, the SB group and the combined group both saw greater changes than
the PA group. Refocusing on educating youth about moderation and why they should limit SB may provoke children to decrease SB in the long-term.

**Intervention Characteristics.** While interventions vary greatly in focus and results, there are several common aspects of intervention program design that must be considered. A review by Stice et al. (2006) examined several aspects of interventions (e.g., delivery, length) and their relationship with effect size. This review found that on average, successful interventions were 40 hr in length, but focusing on the effect gained per hour shows large variability in results and indicates that length is not a conclusive moderator of success. In contrast, it was found that shorter duration in weeks produced larger effect sizes than longer interventions, which may be due in part to participant dropout. Interventions may be conducted at various locations (e.g., home, during school, after-school), be implemented by parents, teachers, or researchers, may involve parents, sibling, or classmates, and may specifically target high-risk groups of children or adolescents.

**Age.** Jago et al. (2005) identified age 7 as a key time for intervention due to finding that the inverse relationship between PA and BMI and the relationship between SB and BMI strengthened with age. Conversely, authors of a review of obesity prevention programs in youth hypothesized that intervention effects would be greatest in programs offered to adolescents due to their improved ability to grasp concepts and skills and may have more autonomy than younger children. While it has been suggested that older youth may be better equipped to grasp intervention lessons and subsequently change desired behaviors, Stice et al. (2006) found that parent involvement in interventions for younger children can increase their effectiveness. Interestingly, effect
size of interventions were found to be high early in life, decreased in childhood until adolescence, then began to increase again.

**Location.** Another point to consider is where children spend the majority of their time and therefore, where an intervention could be most easily and successfully implemented (Guinhouya et al., 2009). The most obvious is that children spend a large portion of their time (6-7 hr/day) in a sedentary school setting (Hofferth & Sandberg, 2001; Pate et al., 2006). This setting often provides limited PA, either due to decreased time allotted for recess and physical education class or due to underutilization of the opportunities provided (e.g., girls and boys spend only 38% and 31% of time in MVPA during recess, respectively) (Lee, Burgeson, Fulton, & Spain, 2007). Schools often do not have additional time outside of their core curriculum to set aside for an intervention focusing on PA and nutrition education. However, in the future this could provide the ideal setting to incorporate an effective intervention into existing health education curriculum.

Outside of the normal school day, after-school programs are often available and may provide additional time for PA, as well as sessions for enrichment education, snack, and homework. Coleman, Geller, Rosenkranz, and Dzewaltowski (2008) suggested that the quality of these after-school programs can be improved by offering healthier snacks, more time for PA, and providing training for staff to promote healthy lifestyle behaviors.

**Social cognitive theory.** To increase likelihood of success, the National Institutes of Health’s Office of Behavioral and Social Research stated that it is important for interventionists to understand social theory and how it relates to an intervention’s goals. Many health-oriented interventions have been based on psychological theory, and Social
Cognitive Theory (SCT) is of particular interest. SCT is based on the idea that there is a triadic relationship between personal factors, the environment, and behavior. This theory includes constructs such as self-efficacy, outcome expectations, reinforcement, and observational learning (Bandura, 1998, 2004). SCT supports the idea that knowledge provides the basis of why one should participate in a certain behavior, but feeling like one can change one’s health habits and observing someone else’s experiences and the results of their actions can affect the likelihood of personal change (Bandura, 2004).

The triadic relationship described by SCT implies that changes in one construct (e.g., increasing self-efficacy) will lead to improvements in other areas (e.g., changes in personal behavior). Research supports SCT constructs as predictors of PA in youth, including outcome expectations, social support, self-regulation, and self-efficacy, which is the most commonly measured construct (Branscum & Sharma, 2012; Harmon et al., 2014; Ramirez, Kulinna, & Cothran, 2012; Stone, McKenzie, Welk, & Booth, 1998; Trost et al., 1997). Furthermore, Thomas (2006) found that statistically significant obesity prevention interventions in youth were either explicitly or implicitly based on SCT and a review by Branscum and Sharma (2012) of after-school obesity prevention interventions found that 11 of the 20 studies were based on SCT. Importantly, this review described how interventions do not inherently modify behaviors, but actually target behavioral precursors, which in turn impact behaviors.

The concept of observational learning is of particular interest when aiming to educate young children. Children may learn through personal experience or more often, by observing the actions of others and the associated consequences. For example, if every child had to learn that a snake bite is dangerous by actually being bitten by a snake, it
would be both time consuming and dangerous. More often, children see a TV show or movie, read a book, or hear someone tell a story about being bitten by a snake. Through these observations children learn to avoid snakes and snake-infested areas without being bitten by snakes themselves.

One classic demonstration of observational learning is Bandura’s bobo doll studies, in which children were first shown a video of an adult playing with a bobo doll (Bandura, Ross, & Ross, 1961). Adults were either violent with the doll, by hitting it with a hammer, throwing, punching and kicking it, or were not violent with the doll. Children were then placed in a room with an identical doll and their behavior was recorded. Children who had observed adults behaving violently towards the doll threw, punched, kicked, and hit the doll with a hammer, while children who saw the control (not aggressive) video did not behave in this manner.

It is important to note that children will not always replicate what they see and several conditions must be met. Children must be paying attention, retain the information, be motivated to replicate the behavior, and be physically able to reproduce the behavior (Schunk, 2012). In the bobo doll studies, children would not have replicated the behavior if they had not paid attention to the video, were not provided a hammer or doll to play with afterwards, or had observed negative repercussions of the violent behavior. Further, the model that children observe must be similar to them in some way, and be perceived as competent. Young children may perceive older children, popular children, doctors, or parents as competent and similarity may be derived from gender, age, hobbies, or environmental cues, like school attendance.
Previous SCT interventions aimed to improve children’s health have focused on nutrition education, long-term changes to school or after-school program design (e.g., adding physical education courses or a healthy snack to existing programs), or structured exercise training (e.g., resistance training) (Annesi, 2006; Dzewaltowski et al., 2010; Freedman & Nickell, 2010). Rarely have studies aimed to increase knowledge of PA benefits, SB consequences, and recommendations and if so, results were often hidden within larger nutrition outcomes (Branscum & Sharma, 2012; Gortmaker et al., 1999). For example, a SCT-based intervention by Belansky et al. (2006), included 28 lessons on nutrition and PA with main outcomes of children’s knowledge, self-efficacy, and attitudes. Following the 2-year intervention, dietary outcomes (knowledge, self-efficacy, attitudes) were significantly different between a no-intervention control and the group receiving the intervention, but PA outcomes were not different. However, the authors stated in the discussion that the intervention focused heavily on diet and diet-related outcomes, despite their original aim to improve PA knowledge (Puma et al., 2013).

Activity-promoting interventions based on SCT aim to increase self-efficacy through exposure to PA in a familiar environment, leading to increased leisure-time PA participation via the triadic relationship (Annesi, 2006). Furthermore, a study by Anderson, Wojcik, Winett, and Williams (2006) found that self-regulation (e.g., self-tracking of PA through record keeping) demonstrated the greatest effect on PA participation. It is clear that SCT-based interventions can have a positive impact on a child’s behavior, but further research is needed on interventions aiming to increase youth’s knowledge.
Future research. Due to the high incidence of childhood obesity and the severity of its complications, it is clear that there is a need for early and effective intervention. An ideal time for this intervention is during childhood and potentially, during an after-school program. These types of interventions have been attempted before with limited success, but success may be improved if the intervention is theory- and education-based. The SCT construct of observational learning is of interest when working with young children, which is important due to the tracking nature of health habits. Using a medium that children relate to, interact with, and enjoy, like a storybook or cartoon characters, may be useful in bridging the gap between educators and youth.

Although much of the literature is anecdotal, there are few studies on the benefit of using children’s literature as a teaching tool capable of modifying children’s behaviors and perceptions. If children can relate to the characters or situations portrayed in a book, literature promotes social understanding and acceptance of new or unfamiliar ideas (Campbell & Wirtenberg, 1980). A study by de Droog, Valkenburg, and Buijzen (2011) assessed the effect of labeling food packages with child-friendly characters on children’s snack preference. In this study, children were offered a healthy snack (banana) and an unhealthy snack (banana candy) in various combinations of a) no character, b) unfamiliar character, or c) familiar character. This study found that packaging with either an unfamiliar or familiar character significantly increased healthy snack choice and request for fruit purchase by the child to the parent (de Droog et al., 2011).

Similarly, a study by Perry, Mullis, and Maile (1985) used a 20-session cartoon character-based intervention to educate children, third to fourth grade, on healthy diet. The intervention used the cartoon characters Hearty Heart and Friends to educate youth...
about nutrition and successfully increased knowledge, preference for healthy foods, and consumption of dark green vegetables and fruit, while decreasing consumption of added salt, fried foods, and sugary cereal. Research on the use of characters or children’s literature for health intervention is lacking, although this type of book-based intervention could be critical in developing a child- and family-friendly educational intervention capable of thwarting the obesity epidemic.

The book *Henry Gets Moving!* by Pierre Rouzier and Chaz Nielsen encompasses important lessons on proper nutrition, exercise, and overall positive social interactions through a creative story outlet. *Henry Gets Moving!* tells the story of a hamster, Henry, who upon moving to a new school, begins to eat poorly and participate in more sedentary activities (video games, TV) than healthier options. With help from his physician and a new friend, Jasmine, he learns the importance of being active and eating healthy. Children’s learning may be improved by observing Henry’s journey to a healthy lifestyle and as a result, children may modify their own behavior. *Henry Gets Moving!* could be the ideal intervention tool, opening up limitless doors to educating, encouraging, and inspiring children nationwide to learn about and make healthier choices.
Chapter 3: Methods

Participants

All first to fourth grade children in the Kids on Campus program at The Plains Elementary (Letter of Support, see Appendix A) provided an anonymous group-level assessment of knowledge before and after the intervention ($N = 21$), while a subset of children ($n = 6$) volunteered for additional anthropometric and objective behavioral measures. Children free of cardiorespiratory, metabolic, neurological, physical impairments, or medications that could affect dietary needs or ability to engage in PA were eligible to participate in the measurement portion of the study.

Recruitment

A study packet was sent home with all children participating in the after-school program, Kids on Campus, at The Plains Elementary School. This study packet informed them and their parents that the Teaching Healthy Exercise and Nutrition Recommendations for Youth (Teaching HENRY) curriculum would be implemented during the enrichment portion of the after-school program for 6 weeks. The packet included a flyer (see Appendix B), parental consent (see Appendix C) and child assent forms (see Appendix D), a health history questionnaire (see Appendix E), and the parent survey (see Appendix F). Those wishing to participate completed and returned the necessary forms and were contacted to verify information and to be provided an opportunity to ask questions about the study. Parental consent and child assent were obtained prior to collection of any baseline measures, per Institutional Review Board requirements.
Questionnaires

Trained research staff administered questionnaires orally to small groups (1-4 children) during the after-school program before and after the intervention lessons. For these anonymous questionnaires, the only identifiers were team and sex. All first to fourth grade children in the Kids on Campus program at The Plains Elementary completed the School Physical Activity and Nutrition Child Survey (SPAN; see Appendix G) and the Healthy Food Knowledge Activity (HFKA; see Appendix H) to assess their ability to discern between PA and SB, knowledge of PA recommendations and health outcomes, PA self-efficacy, and to assess their current PA and SB habits.

The PA portion of the SPAN was derived from the Youth Risk Behavior Survey and has shown acceptable reliability (Hoelscher, Day, Kelder, & Ward, 2003). In previous research by Penkilo, George, and Hoelscher (2008), self-reported PA items showed good test-retest reliability in 322 4th graders (activity over last week $r = 0.86$, sports team participation $r = 0.72$), as did self-reported SB (TV $r = 0.88$, video games/computer $r = 0.91$).

The HFKA was originally designed to assess children’s ability to identify if foods were healthy or unhealthy, but was modified to include 10 items on children’s ability to identify if pictured behavior was active or inactive (Zarnowiecki, Dollman, & Sinn, 2011). Following the original methodology, children were first asked to define “active” and “inactive” and then, the researcher provided a standard definition. Children were shown a photo of a behavior, which the children put into one of three bins, “active” (green check mark), “inactive” (red X), or “I don’t know” (question mark). Research by
Zarnowiecki et al. (2011) indicated good face validity and test-retest reliability ($r = 0.84$) when the original HFKA was conducted in a sample of 192 children, 5-6 years of age.

Appendix I describes the number of items, range of points, and a description of scales used for each question by category. To calculate “PA knowledge,” two multiple-choice SPAN questions on recommendations for daily activity (scored from 0-4 and 0-5), two Likert-style SPAN questions on health outcomes associated with activity (scored from 0-2), and all 10 HFKA questions on the definitions of PA and SB (scored 0-1 for incorrect-correct) were summed for a maximum possible score of 23. To calculate “PA self-efficacy,” two SPAN questions (scored from 0-2) were summed for a maximum possible score of 4. To calculate “self-reported PA,” two SPAN questions on number of days of activity over the last week (scored 0-7), two SPAN questions on previous and current sports participation (scored 0-3 and 0-1), and one SPAN question on use of active transport (scored 0-1) were summed for a maximum possible score of 19. To calculate “self-reported SB,” three SPAN questions on average number of hours/weekday spent on TV, computer, and video games (scored 0-6) were summed for a maximum possible score of 18.

Parents of the subset of children completed the SPAN Parent Survey, which included questions on parent’s height and weight, knowledge, SES, and home environment. Parent’s PA knowledge (maximum 18) was a compilation of one true/false question on health outcomes associated with weight (scored 0-2) and three multiple-choice questions on knowledge of PA and SB guidelines for children (6-8 items each, scored 0-4, 0-5, and 0-7). The survey also included questions on PA environment (maximum 19), with three Likert-style questions (5 items each, scored 0-3) on equipment
availability, safety, and parent encouragement of PA, three multiple choice questions on parent participation in their child’s PA behavior (5-6 items each, scored 0-3), and one multiple choice question on how their child gets to school (3 items, scored 0-1). For completing the questionnaires, children received a small prize (<$2.00 each) and parents were compensated monetarily.

**Anthropometrics**

Children in the consented subset had their height measured to the nearest 0.1 cm using a portable stadiometer (Seca Road Rod 214, Snoqualmie, WA, USA) and weight measured to the nearest 0.1 kg using a digital scale (Lifesource ProFit, Milpitas, CA, USA). These values were used to calculate the child’s BMI (kg/m²) and classify their weight status according to the CDC’s age- and sex-specific BMI classification charts. According to these charts, HW is BMI < 85th percentile, OW is BMI ≥ 85th percentile, and OB is ≥ 95th percentile (Kuczmarski et al., 2000). Waist circumference was measured to the nearest 0.1 cm at the level of the suprailiac crests using a Gulick tape measurer. All measurements were conducted by trained research staff, repeated at least twice and the average was recorded.

**Activity Measures**

Children in the consented subset wore an Actigraph GT3X+ activity monitor (ActiGraph, Pensacola, FL) on their right hip over the iliac crest, in line with the anterior axillary line for 7 days prior to and 7 days following the intervention to assess daily activity levels. The GT3X+ is a lightweight (19 g) and compact (4.6 x 3.3 x 1.5 cm) activity monitor that detects accelerations/decelerations (g), filters out extraneous, nonhuman movement and converts the data to a numerical value (count) (Chen & Basset,
The monitors were fitted on an elastic band and children were instructed to wear the monitor continuously, except while bathing. Children were given a monitor log to take home and record when and why they took the monitor off, to assist with data analysis (Appendix J).

Monitors were initialized and data were downloaded using ActiLife 6.11 software, sampling at 80 Hz and summed over an epoch of 1 s. Weartime was validated using an established protocol with zero data of ≥ 60 min considered as nonwear time and minimum daily wear time of 8 hr (Choi, Liu, Matthews, & Buchowski, 2011). Wear-periods were then checked visually to ensure sleep and other nonwear periods, as determined from participant monitor logs, were not included in analysis. Daily minutes of MVPA, SB, and percentage of time spent in sedentary (0-100 counts/min), light (101-3580 counts/min), moderate (3581-6129 counts/min), and vigorous (≥ 6130 counts/min) intensities were calculated using the established age-appropriate accelerometer cut-points described above (Mattocks et al., 2007). Children were compensated for wearing and returning the activity monitor at each time-point.

**Teaching HENRY Intervention**

The intervention consisted of one 40-min lesson per week for 6 weeks, delivered to all first to fourth grade children in the Kids on Campus program during the enrichment segment of the after-school program. Kids on Campus separates children into three teams based on grade and each lesson was delivered to each team separately. All lesson objectives, activities, and homework are described in Appendix K and based on constructs of SCT, namely observational learning, self-regulation (logging activity levels), and self-efficacy (structured hands-on practice). Briefly, the book was read and
discussed during the first lesson, two lessons focused on PA and SB recommendations and benefits/consequences, two lessons focused on nutrition recommendations and definitions, and one lesson served as a review of all major topics. These six lessons were piloted at another elementary school prior to this study to ensure content was interesting and understandable to youth in this age group. A focus group of Kids on Campus staff was conducted and their comments on children’s enjoyment, participation, and perceived understanding helped to improve the lessons after piloting.

Optional weekly homework assignments promoted inclusion of the parents in the learning experience. All lessons were delivered and supervised by the research coordinator and IRB-approved research assistants. Prizes (< $2.00 each) were provided to encourage children to pay attention, complete homework, and to be actively involved in the lessons. Although the intervention included both nutrition and PA learning objectives, nutrition outcomes are outside the scope of the current thesis and data are not included.

**Data Analysis**

One-way, between subjects ANOVA was used to assess differences in baseline knowledge, self-efficacy and self-reported (and measured for the subset) PA and SB by sex, team, and consent status (anonymous vs. consented). A repeated measures, mixed-model ANOVA was used to assess overall changes from baseline to follow-up in knowledge, self-efficacy, and self-reported PA and SB (within-subjects) of all children by sex, team, and consent status (between-subjects). A repeated measures, within-subjects ANOVA also assessed change from baseline to follow-up in objectively measured PA data of the consented subset of children. A three-way, between-subjects ANOVA was used to assess differences in change score (follow-up raw score minus
baseline raw score) with team, sex, and consent status as main effects. Simple linear regressions between variables were conducted to assess the relationship between changes in PA knowledge, self-efficacy and reported PA and SB for all children. All values at baseline and follow-up are reported as mean ± standard deviation and significance was set at $p < 0.05$. 

Chapter 4: Results

Participant Characteristics

Overall, 21 children completed the anonymous surveys (team 1 \( n = 8 \), team 2 \( n = 4 \), team 3 \( n = 9 \)) to assess knowledge of the recommendations, outcomes, and definitions of PA. Additionally, 6 consented (and assented) children completed anthropometric measures at baseline and objective monitoring of PA levels at baseline and follow-up. On average, consented participants were 7.5 ± 1.2 years of age, 130.1 ± 6.4 cm in height, 27.9 ± 3.9 kg in weight, with a waist circumference of 59.5 ± 8.1 and a BMI percentile of 55.3 ± 29.8. Height differed by team, \( F(2) = 103.1, p < 0.01 \), which was expected due to increasing age across teams, but no other differences were found in anthropometrics by team or sex. Average attendance was 5 ± 1 lessons out of 6 (83 ± 16%) and homework was completed 17 ± 15% of the time, with individual return rates ranging from 0-75%. The consented children completed more homework assignments (\( M = 1.2 ± 1.2 \)) than the anonymous group (\( M = 0.5 ± 0.6 \)), \( F(1) = 7.62, p = 0.01 \). Differences were seen in homework completion by team, wherein younger children completed fewer assignments than older children, \( F(2) = 7.69, p < 0.01 \).

Every parent of the subset of children was overweight (\( n = 5, \) BMI ≥ 25 kg/m\(^2\)) or obese (\( n = 1, \) BMI ≥ 30 kg/m\(^2\)), as determined from self-reported height and weight. On average, parents reported having 3 ± 1 children and were primarily female (1 male). All but one parent (did not respond) reported that the child had a TV in their bedroom and 3 ± 1 video game devices in the home. Overall, PA environment (equipment availability, safety, parent involvement) was reported as 8.2 ± 3.3 out of 19 (43%) by parents.
Physical Activity Knowledge and Self-Efficacy

Children’s survey data is described in Table 2 and broken down by PA knowledge and self-efficacy. Following the intervention, children’s knowledge of the definitions, benefits, and recommendations for PA increased by 14.3% points, \( F(1) = 11.42, p < 0.01 \). Self-efficacy for PA also increased by 22.5% points, \( F(1) = 6.68, p = 0.01 \). There were no differences in baseline or change in knowledge by sex, team, or consent status (consented vs. anonymous). On average, parents scored a 68% on the portion of the survey inquiring about their knowledge of the PA and SB recommendations for their children and health consequences of obesity.

Table 2

*Survey Data of Knowledge, Self-Efficacy, and Self-Reported Behaviors [M(SD)]*

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Follow-up</th>
<th>Change score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge (out of 23)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw</td>
<td>12.4</td>
<td>15.7</td>
<td>3.3</td>
</tr>
<tr>
<td>%</td>
<td>53.9</td>
<td>68.3</td>
<td>14.3</td>
</tr>
<tr>
<td>(SD)</td>
<td>(3.7)</td>
<td>(3.5)</td>
<td>(5.2)</td>
</tr>
<tr>
<td>(SD)</td>
<td>(16.1)</td>
<td>(15.2)</td>
<td>(22.6)</td>
</tr>
<tr>
<td>Self-efficacy (out of 4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw</td>
<td>2.4</td>
<td>3.3</td>
<td>0.9</td>
</tr>
<tr>
<td>%</td>
<td>60.0</td>
<td>82.5</td>
<td>22.5</td>
</tr>
<tr>
<td>(SD)</td>
<td>(1.1)</td>
<td>(1.2)</td>
<td>(1.6)</td>
</tr>
<tr>
<td>(SD)</td>
<td>(27.5)</td>
<td>(30.0)</td>
<td>(40.0)</td>
</tr>
<tr>
<td>Reported SB (out of 18)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw</td>
<td>5.2</td>
<td>3.7</td>
<td>-1.5</td>
</tr>
<tr>
<td>%</td>
<td>28.9</td>
<td>20.6</td>
<td>-8.3</td>
</tr>
<tr>
<td>(SD)</td>
<td>(5.4)</td>
<td>(4.2)</td>
<td>(5.3)</td>
</tr>
<tr>
<td>(SD)</td>
<td>(30.0)</td>
<td>(23.3)</td>
<td>(29.4)</td>
</tr>
<tr>
<td>Reported PA (out of 19)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw</td>
<td>10.8</td>
<td>12.2</td>
<td>1.5</td>
</tr>
<tr>
<td>%</td>
<td>56.8</td>
<td>64.2</td>
<td>7.9</td>
</tr>
<tr>
<td>(SD)</td>
<td>(5.9)</td>
<td>(5.7)</td>
<td>(6.8)</td>
</tr>
<tr>
<td>(SD)</td>
<td>(31.1)</td>
<td>(30.0)</td>
<td>(35.8)</td>
</tr>
</tbody>
</table>

*Significant difference from baseline to follow-up, \( p < 0.05 \). PA = Physical Activity, SB = Sedentary Behavior. Self-reported SB represents hours/day.
Physical Activity Behavior

Due to the small sample size, differences in baseline values or changes scores by team or gender were not completed. Children wore the monitor for an average of 4.8 ± 2.4 days at baseline and 4.2 ± 2.1 days at follow-up, with no significant difference in average daily weartime. Daily MVPA measured in the subset of children ranged from 23 to 54 \( (M = 36.7 \pm 10.3) \) min at baseline and 35 to 53 min \( (M = 44.1 \pm 6.1) \) following the intervention, representing an average increase of 7 min/day of MVPA, \( F(1) = 0.82, p = 0.41 \). Percentage of valid, non-sleep weartime in vigorous PA was significantly higher following the intervention, \( F(1) = 6.84, p < 0.05 \). Percentage of valid, non-sleep weartime spent in MVPA was significantly higher following the intervention, \( F(1) = 9.70, p = 0.03 \). Daily SB (measured) decreased from 11.9 ± 4.2 hr to 11.6 ± 4.1 hr, a difference of 21 min, \( F(1) = 0.27, p = 0.62 \). There were no differences in self-reported PA or SB following the intervention. Self-reported PA and SB are described in Table 2 and activity levels measured by accelerometer are described in Table 3.

Results of the regression analyses are presented in Table 4. There was no relationship between changes in PA knowledge and changes in self-reported PA or screen time behaviors. Changes in PA self-efficacy were not related to changes in PA knowledge, self-reported PA, or screen time.
Table 3

Percentage of Daily, Non-Sleep Weartime by Intensity at Baseline and Follow-Up [M(SD)]

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Follow-up</th>
<th>Change score</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>n = 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedentary behavior (% of day)</td>
<td>77.7 (6.0)</td>
<td>74.3 (7.2)</td>
<td>-3.4 (3.9)</td>
<td>0.18</td>
</tr>
<tr>
<td>Light PA (% of day)</td>
<td>18.1 (5.1)</td>
<td>20.6 (5.7)</td>
<td>2.5 (3.7)</td>
<td>0.27</td>
</tr>
<tr>
<td>Moderate PA (% of day)</td>
<td>2.6 (0.8)</td>
<td>3.2 (1.0)</td>
<td>0.6 (0.4)</td>
<td>0.06</td>
</tr>
<tr>
<td>Vigorous PA (% of day)</td>
<td>1.6 (0.5)</td>
<td>1.9 (0.6)</td>
<td>0.4 (0.4)</td>
<td>0.04*</td>
</tr>
<tr>
<td>Moderate-to-vigorous PA (% of day)</td>
<td>4.2 (1.2)</td>
<td>5.1 (1.6)</td>
<td>0.9 (0.7)</td>
<td>0.03*</td>
</tr>
</tbody>
</table>

*Significant difference from baseline to follow-up, p < 0.05. PA = Physical Activity.

Table 4

Linear Regression of Changes in Knowledge, Self-Efficacy, and Reported Activity (Adjusted $R^2$/p value)

<table>
<thead>
<tr>
<th></th>
<th>Knowledge</th>
<th>Self-efficacy</th>
<th>Reported PA</th>
<th>Reported SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>-</td>
<td>0.04</td>
<td>0.15</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.02*</td>
<td>0.02*</td>
<td>&lt;0.01*</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>0.04</td>
<td>-</td>
<td>0.01</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>0.02*</td>
<td></td>
<td>0.03*</td>
<td>0.02*</td>
</tr>
<tr>
<td>Reported PA</td>
<td>0.15</td>
<td>0.01</td>
<td>-</td>
<td>0.61</td>
</tr>
<tr>
<td></td>
<td>0.02*</td>
<td>0.03*</td>
<td></td>
<td>&lt;0.01*</td>
</tr>
<tr>
<td>Reported SB</td>
<td>0.13</td>
<td>0.05</td>
<td>0.61</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>&lt;0.01*</td>
<td>0.02*</td>
<td>&lt;0.01*</td>
<td></td>
</tr>
</tbody>
</table>

*Significant relationship, p < 0.05. PA = Physical Activity, SB = Sedentary Behavior.
Chapter 5: Discussion

The aim of this study was to assess the feasibility of a character-based intervention for improving knowledge of the definitions, outcomes, and recommendations for PA and SB as well as participation in these behaviors in rural Appalachian children. This character-based intervention increased children’s knowledge and self-efficacy, with nonsignificant, but practically important changes in PA and SB participation. Traditional PA interventions provided structured opportunities for children to increase daily activity levels, but did not target a major reason children may not be adhering to established recommendations, which is simply that they do not know how often, how long, or why to be active. While educating young children may be difficult, use of an age-appropriate medium and role models may help bridge the gap between educators and children and encourage adoption of healthy behaviors.

Improvements in Knowledge and Self-Efficacy

Knowledge. The current study elicited improvements in children’s knowledge of what constitutes healthy and unhealthy activity (PA and SB), age-appropriate recommendations, and benefits and consequences of these behaviors. According to SCT, knowledge is one of the foundations of the triadic and reciprocal relationship between environmental, behavioral, and cognitive factors (Bandura, 1998). This reciprocal relationship implies that increases in knowledge should lead to improvements in children’s behavior. Little research exists on the effect that improving PA and SB knowledge has on children’s habits, but the relationship between knowledge and behavior is recognized (Sallis et al., 2000). For example, Ferguson, Yesalis, Pomrehn, and Kirkpatrick (1989) demonstrated that sixth to eighth grade adolescent’s knowledge of the
benefits of exercise related to and helped predict current exercise behavior ($R^2 = 0.34$) and intent to exercise ($R^2 = 0.45$). The current intervention is distinct in its aim to educate youth about the definitions, recommendations, and benefits and consequences of PA and SB in an effort to also change habits.

A review by van Sluijs et al. (2008) illustrated how health education interventions have typically focused on nutrition education in the traditional sense of the word, such as learning recommended daily intakes or portion sizes, but PA education typically refers to “gym class.” For example, the Cardiovascular Health in Children Study by Harrell et al. (1996) improved “health knowledge” by almost 8% following an 8-week intervention that included education on the health benefits of proper nutrition and health consequences of smoking, but offered only PA opportunities instead of education about PA. Ling et al. (2014) also aimed to use “health education” to increase the number of children who met the recommendations for healthy nutrition and PA. Although this intervention demonstrated an increase from 1% of the participants meeting PA goals to 5% (measured by pedometer), it did not include the recommended amount or the benefits of daily MVPA as learning objectives (Ling et al., 2014). It is unclear why interventions have focused solely on providing opportunity for PA, which has low success in improving PA outside of the intervention, instead of educating children about how and why to be physically active (Dobbins, Husson, DeCorby & LaRocca, 2013; Gutin et al., 1999; Stone et al., 1998).

Few interventions have aimed to increase children or families’ dietary knowledge and successfully included PA education, although the emphasis was minimal. For example, the 2-year Integrated Nutrition and Physical Activity Program completed in
rural elementary schools by Belansky et al. (2006) included 28 lessons on nutrition and PA with main outcomes of children’s knowledge, self-efficacy, and attitudes. Following the 2-year intervention, changes in dietary outcomes (knowledge, self-efficacy, attitudes) were significantly different between a no-intervention control and the group receiving the intervention, but changes in PA outcomes were not different. However, the authors stated in the discussion that the intervention focused heavily on diet and diet-related outcomes, which may explain why PA knowledge, attitudes, and self-efficacy did not change (Puma et al., 2013).

In contrast, a study by Hodges, Kulinna, and Lee (2014) focused solely on PA knowledge when they implemented a 5-week intervention consisting of 12-min educational fitness activities during physical education class. These activities were similar to those used in the current study, such as obstacle courses and active games with learning objectives related to the benefits and recommendations for PA. Following the intervention, health behavior knowledge was significantly increased in the six intervention schools compared to five control schools. Unfortunately, this study did not measure behavior before or after the intervention.

A more balanced educational intervention that included PA and nutrition knowledge and behavior outcomes was conducted by Nemet, Geva, and Eliakim (2011) over the course of a year in kindergarten children and demonstrated a significant increase in both diet (increased from 58% to 84%) and PA knowledge (increased from 55% to 85%) following the intervention. However, implementation of a year-long intervention with 45 min/day of structured PA is not always feasible in today’s schools focused on the required core education outcomes. The current study aimed to ascertain if a more brief
intervention (six 40-min lessons) could elicit similar improvements in knowledge and behavior. In just six lessons, the current study demonstrated a 13.5% increase in PA knowledge, nearly half of the improvement seen from the year-long endeavor reported by Nemet et al. (2011).

Important, Nemet et al. (2011) noted the markedly lower baseline knowledge score of children in their study (low SES) compared to a similar previous study by the same authors (middle-to-high SES). Nemet, Geva, Meckel, and Eliakim (2012) demonstrated that middle-to-high SES children had significantly higher PA knowledge (68% vs. 53%), but not PA preferences (66% vs. 56%) compared with low SES children. The after-school program used for the current study targeted economically and academically at-risk youth and underserved, low SES families, so this may explain the similarly low baseline knowledge scores (51.9%).

Cross-sectionally, research supports a relationship between knowledge and participation in health behaviors, but research on PA specifically is lacking (Biddle & Goudas, 1996; Sallis et al., 2000). For example, Wardle, Parmenter, and Waller (2000) found that adults in the highest quintile of nutrition knowledge were 25 times more likely than those in the lowest quintile to eat a diet with adequate fruits, vegetables, and lower in excess fat. DiLorenzo, Stucky-Ropp, Vander Wal, and Gotham et al. (1998) described how PA knowledge predicted future PA participation in fifth and sixth grade boys. Research on how improving knowledge affects participation in recommended behaviors longitudinally is lacking. A six-lesson nutrition education intervention by Powers, Struempler, Guarino, and Parmer (2005) led to significant improvements in both knowledge and dietary behavior, but there was only a weak association between the
change in knowledge and the change in behavior. Accordingly, the current study found positive changes in knowledge, self-efficacy, and self-reported behavior from baseline to follow-up, but nonexistent to weak associations between these changes. Further research is needed to delineate how changes in knowledge and other variables, like self-efficacy, are related to changes in children’s behavior.

**Self-efficacy.** Self-efficacy, the feeling that one can do something, has been positively correlated with PA participation (Sallis et al., 2000; Strauss, Rodzilsky, Burack, & Colin, 2001). The current study demonstrated a significant increase in children’s self-efficacy, which may result in continued PA participation outside of the intervention setting, although more research is needed as the relationship between changes in self-efficacy and behavior was nonexistent. Importantly, self-efficacy is a cornerstone of SCT and can be increased through experience as well as encouragement and observation of successful peer models (Pajares, 1997). This may be the mechanism through which the current intervention led to increased self-efficacy, as children were provided time to be physically active and observed the model, Henry the Hamster, becoming more successful at PA and demonstrating positive health benefits from the increased behavior. Other interventions have noted similar increases in self-efficacy following exposure to structured PA (Brown, Hume, Pearson, & Salmon, 2013). While self-efficacy and other personal factors have been shown to influence children’s activity levels, social and family aspects also play a role, as children are largely dependent on others. Parent knowledge, encouragement, and PA and SB participation are especially important as children learn through observation and often do what their parents do.
Parent Knowledge. A study by Debastiani, Carroll, Cunningham, Lee, and Fulton (2014) found that only 9.7% of parents knew the recommendation for children’s PA (60 min every day of the week) and knowledge decreased with SES. In the current study, only one parent correctly identified this recommendation. While 66.7% of parents knew the “60 min” portion of the recommendation, only 1 knew the “every day of the week” clause and most chose the response “I don’t know,” which is similar to the findings of Debastiani et al. (2014). Interestingly, almost all parent responders in the current study were mothers (5 out of 6), and previous research has shown women to be 30% more likely to know the government recommendations for PA (Moore, Fulton, Kruger, & McDivitt, 2010). Debastiani et al. (2014) found that 65.2% of parents were unaware that a recommendation had even been published for children’s PA, which is troubling because the current recommendation for children’s PA was published 7 years ago in 2008 (DeBastiani et al., 2014). The American Academy of Pediatrics released its statement on screen time and SB in 2013 and a study by Funk, Brouwer, Curtiss, and McBroom (2009) found that only 34% of preschooler’s parents could correctly identify the recommendation. In the current study, all but one parent (who chose “I don’t know”) underestimated the screen-time recommendations for children. While this may seem like a positive finding, it is likely that parents simply chose the lowest time available as a response due to social desirability. The survey used did not question if parents knew the negative consequences (e.g., weight gain, vision and sleep problems) associated with excess screen-time. Further, parents only completed the questionnaire at one time-point, so changes in knowledge following the intervention were not assessed.
One positive aspect of using a character/book-based intervention is that it provides an easy gateway into the home as children can read the book with, and possibility educate, their parents or siblings. Research has demonstrated the parental influence on a child’s PA and SB participation (Jordan et al., 2006; Sallis et al., 2000). For example, Moore et al. (1991) found that children, 4-7 years of age, with one active parent (via accelerometry) were two to four times more likely to be active than children with an inactive parent and almost six times more likely if both parents were active. Further, a qualitative study by Jordan et al. (2006) found that parent’s own screen-time habits were cited as a barrier to encouraging their children to abide by the 2-hour/day recommendation, even when parents knew the consequences of too much SB. In the current study, all parents reported that they were physically active, were physically active with their child, and watched their child be physically active at least some of the time. Unfortunately, most parents reported some barriers to their child being active, such as inability to ride a bike on busy streets near their home, wild animals, or unsafe neighborhoods. These types of barriers have been supported by other research in the rural Appalachian region (Swanson et al., 2013).

These findings suggest that parents know their children should be active, but they may not know how to overcome barriers to PA and be active in their current environment. Parents may be confused about what activities “count” towards the recommended daily dose of MVPA, the frequency and duration of PA recommended, and may be unaware of the health consequences of obesity, too much SB, or inadequate MVPA.
Physical Activity Behavior Changes

Moderate-to-vigorous physical activity. Activity behaviors were self-reported and in some children, also measured objectively. Self-reported (SPAN) PA score increased 7.8% following the intervention. This section of the questionnaire mostly dealt with the number of days in the last week the child was active for at least 60 min, but also included information on active transport and extracurricular team sport participation. Transport mode and prior team participation was not likely to change following this brief intervention, so this may dampen the results. When solely looking at a question that asked youth on which days they were active for at least 60 min, children reported an average of 1 additional day of participation following the intervention. Children also reported twice as much outdoor time following the intervention, which could be due to change in weather as the study started at the end of February and ended in April.

Due to the potential inaccuracy of self-report, accelerometers were used as an unbiased measure of daily activity levels. In the current study, the increase in measured minutes of MVPA did not reach significance, but may represent practical significance. The U.S. Report Card on Physical Activity stated that 6-11-year-old children attain an average of 88 min/day of MVPA, but only 24% of 11-year-olds met the recommendation of 60 min every day (Dentro, 2014). At baseline in the current study, children only averaged 36.7 min/day of MVPA and none achieved 60 min/day every day. However, 7% of the subset children’s valid wear days elicited \( \geq 60 \) min of MVPA at baseline, which increased to 16% of valid wear days following the intervention.

Research on the effect of seasonal changes on children’s PA has shown mixed results. Most studies carried out in the United Kingdom have agreed that PA levels are
higher and SB levels lower in the summer than the winter. However, data in the United States have varied due to lack of consistency in location (e.g., Texas vs. Massachusetts) and measurement protocol (e.g., direct observation vs. accelerometry) (Rich, Griffiths, & Dezateux, 2012). As there are a lack of data from locations similar to the current study (Ohio), no conclusions can be drawn on whether the increase in MVPA and decrease in SB was simply due to more favorable weather. However, data from the AccuWeather website show that average temperatures during the week of baseline measures in the current study was 47 ± 9 degrees Fahrenheit. At follow-up, the average temperature was 62 ± 7 degrees Fahrenheit. This small difference in temperature probably did not affect PA levels.

Children attained an additional 7 min of MVPA a day following the intervention and due to the dose-response relationship between PA and overall health risk, these additional 7 min are important (Janssen & LeBlanc, 2010). Further, the energy surplus associated with childhood obesity has been reported as an average of 100 kcal/day in 7-17-year-olds or from 14 kcal/day in 2-7-year-olds to 97 kcal/day in 5-7-year-olds and more than 250 kcal/day in 12-17-year-olds (Butte et al., 2007; Wang, Gortmaker, Sobol, & Kuntz, 2006). For a 45 kg child playing basketball continuously for 7 min, estimated energy expenditure (via Schofield’s equation) would be 64.6 kcals (Ridley et al., 2008). Due to the intermittent nature of children’s PA, it is likely more than 7 min would be needed to negate the energy deficit associated with obesity, but this is simply an illustration of how important those 7 min could be, particularly if implemented early in life and coupled with changes in SB.
Sedentary behavior. Most research on SB has either examined the relationship between SB and health outcomes in a cross-sectional manner or has prescribed a dose of SB and examined the subsequent effects on health outcomes (Mark & Janssen, 2008; Epstein et al., 2002). However, an intervention by Robinson (1999) aimed to make third and fourth grade children more aware of their SB duration and encouraged them to attain less than 7 hr/week of screen-time. Children decreased overall self-reported screen-time by 9.6 hr/week, or 1.4 hr/day, which is similar to the current study (1.5 hr/day).

Both accelerometer and self-report were used by the current study to obtain a more complete picture of children’s habits. Measurement of SB by accelerometry is difficult, but the cut-point of 100 counts/min has been highly correlated with direct observation of various modes of SB (Kozey-Keadle et al., 2011). While accelerometry cannot differentiate between positive SB (e.g., homework) and behaviors associated with greater health risk (e.g., screen time), self-report can (Lubans et al., 2011). In the current study, the accelerometer data indicated a 21 min average decrease in daily valid, non-sleep SB. Importantly, Table 3 suggests that SB was replaced by both light PA and MVPA. At baseline, children self-reported 5.2 hr of screen-time on an average weekday, which is similar to levels found in other studies (Rideout et al., 2010). Children self-reported 1.5 fewer hours of daily screen time following the intervention, which is positive, because the intervention aimed to educate youth on the recommendations and consequences of screen-time SB in particular. The discrepancy between the two measures (21 min vs. 1.5 hr) could be due to the measures being unreliable, children underreporting SB due to increased knowledge, or replacement of screen-time SB with other types of SB (e.g., reading). These preliminary findings indicate that the intervention, based on a child-
friendly storybook, successfully increased children’s knowledge of healthy PA and SB and that this increased knowledge may lead to improved behaviors.

Use of a Child-Friendly Character and Medium

Few studies have explored the use of a child-friendly character as a healthy lifestyle intervention tool, although the tactic of capitalizing on a likeable character has been successful in marketing for decades (McNamara, Kurth, & Hansen, 1981). Research on the use of “spokes-characters,” like the Michelin Man or Snuggle the Bear, provide insight on how characters can affect people’s behavior. Perceptions of trust between consumers and the character and perceived character expertise have been shown to modify product purchasing and attitudes toward a brand (Garretson & Niedrich, 2004). Similar effects could be seen from exposure to Henry the Hamster on children’s attitudes toward and participation in healthy behaviors.

It is well known that children do not learn everything through experience, because that would be dangerous and time-consuming. Instead, children learn by modeling others, particularly those they see as similar to themselves and competent. Obviously children do not replicate every behavior they observe; they must be paying attention, motivated to replicate the behavior, and physically able to reproduce the behavior. The current study employed theory-based methods to encourage children to model the behaviors demonstrated in the Henry Gets Moving! book, such as PA logs as a tool for self-monitoring, positive reinforcement through verbal encouragement and small prizes, using group work to encourage peer support for healthy changes, and increasing self-efficacy through practice and skill-based learning. Additionally, similarities between characters in the book and the children were emphasized, to promote modeling.
There is limited research on the use of characters to modify health behaviors in children. A study by de Droog et al. (2011) assessed the effect of labeling food packages with child-friendly characters on children’s snack preference. This study offered a healthy snack (banana) and an unhealthy snack (banana candy) in various combinations of a) no character on label, b) unfamiliar character on label, or c) familiar character on label. This study found that packaging with either an unfamiliar or familiar character significantly increased healthy snack choice and request for fruit purchase by the child to the parent (de Droog et al., 2011). A study by Perry et al. (1985) used a 20-session cartoon character-based intervention to educate children, third to fourth grade, on healthy diet. Similar to the current study, the intervention was based on the idea that exposure to modeling from the characters, Hearty Heart and Friends, coupled with increased knowledge and modification of behavioral factors, like practicing skills and self-monitoring, would lead to adoption of a healthy lifestyle. The intervention was successful in increasing knowledge, preference for healthy foods, and consumption of dark green vegetables and fruit, while decreasing consumption of added salt, fried foods, and sugary cereal. Perry et al. (1985) used projected images of the characters to tell brief stories about salt and fat consumption before providing children hands-on experience making healthy snacks. Perry (2004) went on to describe that she chose to make the Hearty Heart series because she wanted a compelling and age-appropriate role model that children would pay attention to more than traditional teaching methods. Unfortunately, Perry (2004) found that improvements in health behavior did not persist a year after the intervention, indicating the need for a medium that children can use on their own or with their parents over time to reinforce the school-time lessons.
Child-friendly storybooks have been implicated as a way to engage children and promote acceptance and understanding of new ideas, but research is limited on the use of storybooks to modify health behaviors and no research has used this method to promote PA and SB. Previous research by de Droog et al. (2014) demonstrated the effect of reading a storybook promoting carrots as a healthy food that makes you feel “fit and strong” to children, 4-6 years of age, and found significantly higher levels of carrot consumption after reading the book compared to a control group (de Droog et al., 2014). A study by Byrne and Nitzke (2002) compared children’s willingness to taste the vegetable kohlrabi before and after reading a book with positive messages about the vegetable, reading a book with negative messages about the vegetable, or reading no book (control), but found mixed results. However, absences and a higher (than other groups) number of children willing to taste kohlrabi at baseline in the positive-message group muddled the findings of this study. The current study used child-friendly characters as role models for healthy behavior and an age-appropriate storybook to disseminate information about recommendations and benefits and consequences of health behaviors, to include PA and SB. This area of research is promising and future research should focus on the storybook approach for modifying children’s behavior, as it may be ideal in the development of an effective and child-friendly intervention.

Significance

Current estimates show that less than half of youth follow the published recommendations for daily PA and SB for healthy growth and development, while over a third of children are overweight (Dentro, 2014). Numerous researchers, practitioners, and laypeople are looking for ways to combat the widespread childhood obesity epidemic,
which is even more profound in impoverished and destitute areas like rural Appalachia (Montgomery-Reagan et al., 2009). Previous interventions have not focused on educational objectives, such as the definitions and recommendations for daily activity, but rather, have provided youth with structured opportunities for PA (Branscum & Sharma, 2012; Brown et al., 2013; van Sluijs et al., 2008). While this approach has shown low-to-moderate success, it does not target the key reason children are not meeting the recommendations in the first place, which is simply that they do not know or understand the recommendations (Roberts & Marvin, 2011). Further, the likelihood of implementing this type of daily, structured activity is low in today’s curriculum-focused schools and these interventions are often focused on one behavior and as such, do not account for the intertwined relationship of PA, SB, diet, peer influence, and family environment on a children’s risk for obesity.

For these reasons, there is a need for a successful, succinct, age-appropriate, and cost-effective way to educate young children on healthy lifestyle habits to ultimately improve their behavior in the short and long-term. As young children learn through observation as well as experience, providing them with a role model for living a healthy lifestyle is the ideal way to encourage them to participate in recommended behaviors. Use of a child-friendly medium (storybook) makes the information attractive to this audience and easy to disseminate to the social and familial circles (Campbell & Wirtenberg, 1980). In the long-term, this type of intervention has the potential to encourage adoption of lifelong healthy habits that are based on a strong foundation of knowledge.
Limitations

As with all research, this study is not without limitations. As the book was originally intended for a younger age group, fourth grade may have been too old to maintain interest, while kindergarten should be included in future studies. This study had a very high dropout rate and low sample size primarily due to poor weather, school cancellations, and the nature of the afterschool program, in which attendance was not mandatory. Future research should employ a control school and include long-term follow-up measures to assess the sustainability of these results.

The surveys used for this study are an important limitation. The SPAN was validated for recall in fourth grade youth, while the HFKA was validated for reliability and reproducibility in 5- and 6-year-old children (Hoelscher et al., 2003; Zarnowiecki et al., 2011). To bridge this age gap, we read the SPAN aloud to small groups of children, but comprehension may still have been an issue. Importantly, no differences in knowledge at baseline or change in knowledge following the intervention were seen by team (indicative of grade or age), so this was likely not an issue. Completion of parent questionnaires at follow-up would be useful to see if children who brought home the book and completed the homework aided in educating their parents on the lessons learned throughout the intervention. With the young age of the targeted children and their inherent lack of autonomy in regard to their dietary and PA choices, it is important to also positively impact the parent’s knowledge, and thus behavior, to see more positive changes within the home.

Self-report of PA or SB in children (and adults) may be inaccurate (Sallis, Buono, Roby, Micale, & Nelson, 1993). Although the sample size was small (n = 6), the
relationship between observed and reported PA and SB may shed some light on this issue as it relates to the current study. For example, self-reported SB was not related to measured min of SB ($R^2 = -0.27$) at baseline, but this relationship strengthened at follow-up ($R^2 = 0.58$). This may be due to children becoming increasingly aware of the duration of their SB. Self-reported PA was not related to measured min of MVPA at baseline ($R^2 = 0.01$) or follow-up ($R^2 = 0.10$). This may be due to the types of questions asked about PA, which were broad (e.g., sports teams participation, which days did you play outside for 60 min). Alternatively, the questions on reported SB asked specifically how many hours the child spent on a specific task (e.g., TV).

Even if children did not actually change their behavior, they may have reported more PA or less SB activity due to an increase in knowledge of what constitutes a healthy lifestyle (potential social desirability bias). In a study of adult women, it was found that PA was typically over self-reported by 4 min/day, regardless of weight status (Adams et al., 2005). Interestingly, a study of African-American girls, 8-10 years of age, found that younger girls were more likely to overreport PA due to social desirability (Klesges et al., 2004). Objective measures, like accelerometry, of these behaviors will be crucial for assessing true changes in future studies. Although, accelerometers have their own set of inherent problems, such as differentiating between nonwear time and SB, and it has been suggested that a combination of objective and self-report methods may be best suited for children. Lastly, due to unique characteristics of the rural Appalachian, the generalizability of these findings is unknown.
Future Directions

Future studies should employ a control school and eventually, provide a control intervention to see if character-based interventions are more effective than either no intervention or an intervention not using this child-friendly medium. The current study has aimed to develop lessons suitable for laypeople to use in a classroom or after-school setting that do not rely on numerous supplies or staff expertise. If this type of intervention is validated by future research, it would provide an inexpensive and easy intervention tool that could be implemented by schoolteachers, daycare providers, and other laypeople. Further, more books in the *Henry Gets Moving!* series could further educate children on specific activity or dietary topics.

In conclusion, this character-based educational intervention significantly improved young children’s knowledge and self-efficacy, with nonsignificant, but practically important changes in participation in recommended activity behaviors, such that screen-time decreased, while daily PA levels improved. Future research should determine whether a character-based intervention could have long-term effects on knowledge and behavior and whether this type of intervention is preferable to traditional intervention methods.
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Appendix A: After-School Program Letter of Support

COMMUNITY PARTNERS’ LETTERS OF SUPPORT

Ohio University
College of Health Sciences and Professions

August 8, 2014

Dear IRB Committee;

I am writing this letter to express support for Dr. Cheryl Howe’s research project, Teaching HENRY: Healthy Exercise and Nutrition Recommendations for Youth.

Kids on Campus has been an established part of the Athens County community throughout the last eighteen years. Because of this we can serve as the community partner for this research project, giving Dr. Howe access and support within the school systems and the surrounding communities.

The goal of this project is to promote an active lifestyle for children and their families by encouraging them to increase their physical activity and nutrition knowledge and habits. This aligns with Kids on Campus’s goals to help the students, families, and surrounding communities to lead a healthier lifestyle.

It is for these reasons that Kids on Campus wholeheartedly supports this funding request to support the Teaching HENRY research.

Sincerely,

Amanda J. Brooks
Assistant Program Manager
Kids on Campus
Appendix B: Recruitment Flyer

Teaching HENRY!
Healthy Exercise and Nutrition Recommendations for Youth

For more information contact:
Cheryl Howe, PhD
Phone: 740-593-2888
howec@ohio.edu

HENRY, the hamster, is coming to your Kids on Campus program
- including 6 lessons on healthy eating and physical activity

You can earn prizes by answering questions about your physical activity and
nutrition knowledge and by doing some fun activities during the program and
at home with your parents.

If you wish to be eligible for additional prizes and you are:
⇒ Healthy
⇒ In 1st, 2nd, 3rd or 4th grade
⇒ Attend Kids on Campus after-school program
We would like to measure your height, weight, waist and your
physical activity and nutrition habits (more information is included inside packet).
Appendix C: Parent Informed Consent Document

Ohio University Parental Consent Form

Title: Teaching HENRY: Healthy Exercise and Nutrition Recommendations to Youth

Study Researchers: Kimberly A Clevenger, BS; Cheryl A Howe, PhD

You are being asked permission for your child, _______________________, to participate in a research study. For you to be able to decide whether you want your child to participate in this study, you should understand what the study is about, as well as possible risks and benefits in order to make an informed decision. This process is known as informed consent. This form describes the purpose, procedures, possible benefits, and risks. It also explains how your child’s personal information is used and protected. Once you have read this form and your questions about the study are answered, you be asked to sign it. This will allow your child’s participation in this study. You should receive a copy of this document to keep.

Explanation of Study

This study is measuring the effectiveness of using a children’s book-centered lesson plan to teach children about healthy nutrition and activity choices. If you and your child elect to participate - your child will be one of 30 children selected to be a participant because he/she is a 1st, 2nd, 3rd, or 4th grade child (6-12 years old) who is enrolled in the Kids on Campus afterschool program at The Plains Elementary. You will be asked to complete a health history questionnaire on behalf of your child as a health screening tool. All children must be free from any cardiovascular, metabolic, or respiratory diseases or physical impairments that affect their physical activity or nutrition choices and must be willing to participate in this study.

If your child is eligible and wishes to participate, a researcher will visit the Kids on Campus program to measure your child’s height, weight, and waist circumference. After these measurements are complete, your child will be fitted with an activity monitor around their waist with an elastic strap. This activity monitor will measure your child’s physical activity level over the next 7 days and you will be asked to help your child keep a daily journal of when he/she removes the sensor (to sleep or bathe). While your child is wearing the activity monitor, we will visit your child’s school to observe their food choices and eating habits during school meals. You will also be asked to complete the Parent Survey asking you about your personal information (education level, height, weight, etc.), physical activity and nutrition knowledge and habits, and information about your child and family.

☐ No, I do not want to be in this research project.
☐ Yes, I do want to be in this research project.
Once all of these measurements are complete, we will begin our weekly visits to the school to teach lessons on healthy eating and activity habits to all of the 1st through 4th grade children in the Kids on Campus program, even those who do not participate in the study. After 6 weeks of lessons, we will ask your child to complete the questionnaires they completed before the lessons began. We will also observe their food choices and eating habits during breakfast and lunch in the school cafeteria and we will ask them to once again wear the activity monitor for 7 days to measure their physical activity level.

**Possible Risks and Discomforts**

The risk during this study is minimal as your child is being asked to participate in their normal daily routine. Your child may experience some minor discomfort from wearing the activity monitor, which will subside once removed. Your child may wear the monitor over their clothing to reduce the risk of any possible skin irritation from the monitor.

**Benefits**

Your child may not benefit from participating in this study. Participation in this study will simply allow your child to contribute to our knowledge about effective ways to teach children about making healthy choices.

**Confidentiality and Records**

Your child’s information will be treated as privileged and confidential. Your child will not personally be identified if the results are published. All data collected will be numerically coded for data analysis, thereby assuring anonymity for all individuals. All personal study information will be maintained in a locked cabinet in the Dr. Howe’s research laboratory or office until the study is over. After the study has been published, all personal information will be destroyed and only the numerically-coded data will be kept.

**Compensation**

Any child who returns this study packet to the Kids on Campus staff with your signature, regardless if they wish to participate or not, will receive a small prize (value under $2.00). All 1st - 4th grade children in the Kids on Campus program at The Plains Elementary will receive their own copy of the book (Henry Gets Moving!) to take home. If you and your child are eligible and wish to participate in the measurements portion of this study, your child will also receive a small award for completing the measurements before and after the 6-week program. If the child participates in all the measurements, including returning the activity monitor, they can receive a total of $30.00 for the study ($15.00 per session x 2 sessions). During the 6 weeks of lessons, your child will be asked to complete several homework assignments with your assistance. For returning the completed homework, your child will also be awarded small prizes (value under $2.00). As the parent, for completing the study packet, including the Parent Survey, you will receive an incentive of $15.00 for your time and effort (one parent per child).
Parents Participation Decision for their Child:

☐ No, do not want my child to participate in this research project. I understand by checking this box, I do not have to complete any of the questions below or in the rest of the packet.

☐ Yes, I do want my child to participate in this research project. I understand that by checking this box, I am being asked to complete the rest of the questions below and the other papers in this packet.

Parents Media Decision for their Child:

Occasionally during the program, we would like to document the children’s participation with photographs. Your child’s name will not be identified on any of the photos. Not agreeing to allow your child’s photo taken does not prevent them from participating in the research study in any way.

☐ No, I do not agree to allow my child to be photographed by the Teaching HENRY team from Ohio University to be used to present the study findings at local/national conferences or educational formats.

☐ Yes, agree to allow my child to be photographed by the Teaching HENRY Research team from Ohio University to be used to present the study findings at local and national conferences or educational formats.

Request for Additional Information

You and your child are encouraged to ask questions about the study. The researchers will answer your questions to the best of their knowledge. The researchers fully intend to conduct the study with your child’s best interest, safety, and comfort in mind. Should you have any questions about your child’s treatment or any other matter relative to your child’s involvement in this study, you may call Dr. Cheryl Howe at (740) 593-2888 (howec@ohio.edu). If you have any questions regarding your child’s rights as a research participant, please contact Jo Ellen Sherow, Director of Research Compliance, Ohio University, (740) 593-0664.

By signing this consent form, you are agreeing that:

· You are the legal parent/guardian of the child identified below.
· You have read this consent form (or it has been read to you) and have been given the opportunity to ask questions and have them answered.
· You have been informed of potential risks to your child and they have been explained to your satisfaction.
· You understand Ohio University has no funds set aside for any injuries your child may receive as a result of participating in this study.
· You are 18 years of age or older.
· Your child’s participation in this research is completely voluntary.
· Your child may leave the study at any time with no penalty to your child and he/she will not lose any benefits to which he/she is otherwise entitled.

**Parent Information**

- Parent’s Name: ___________________ Relationship to Child: ___________________
- Parent’s Signature: ___________________ Date: ___________________
- Address: ________________________________________________________________

Phone: Home: _______________ Work: _______________ Cell: _______________
Email: ___________________________ Preference: Home Work Cell Email Text

**Child’s Information:**

- Name: __________________________________________ Date of Birth: _________
- Age: _____ Sex: Boy   Girl   Race: _________________ Grade: 1st   2nd   3rd   4th

**Please do not write in this box:**

**Study Representative Statement:**
I have explained the purpose of the research, study procedures, possible risks and discomforts, possible benefits, and have answered any questions to the best of my ability.

Study Representative Name (print or type) Signature Date
Appendix D: Child Assent Document

Ohio University Assent Form

Title: Teaching Healthy Exercise and Nutrition Recommendations to Youth Study
Researchers: Kimberly A. Clevenger, BS; Cheryl A Howe, PhD, CES

We are doing a research project on teaching children about healthy nutrition and activity choices by using the book Henry Gets Moving! A research study is a way to learn more about people. There are some things about this study you should know. This study will be done at your school during the Kids on Campus program. If you decide that you want to be part of this study, your height, weight, and the distance around your waist will be measured. Also, you will be asked to wear a small red monitor on your hip to measure your activity level whenever you are not swimming or in the shower or bathtub for 7 days. It is important that you wear the monitor at all times, except while in the shower or bathtub. If the monitor rubs your skin, you may wear it over your clothing. While you are wearing the monitor, you will be asked to write down every time you take it off and put it back on and why. We will also visit your school twice to see what and how much you eat during school meals. We will take your tray after you finish your meal and measure how much food is left. After the Teaching HENRY program is over, we will ask you to wear the monitor again for another 7 days.

Not everyone who takes part in this study will benefit from it. Benefit means that something good happens to you. We feel that this study might increase your knowledge of healthy nutrition and physical activity choices. This could be considered a benefit.

When we finish the study we will write a report about what was learned. This report will not include your name or that you were in the study.

You do not have to be in this study if you do not want to be. If you decide to stop after you begin, that is okay too. For being in the study you may receive some small prizes with values less than two dollars, including a prize for returning this packet to the Kids on Campus teachers with your parent’s signature, even if you do not wish to participate in the study. For completing the measurements and bringing back the activity monitor each time, you can earn up to $15.00 for a total of $30.00 for the study.

☐ No, I do not want to be in this research project.
☐ Yes, I do want to be in this research project.

If you decide you want to be in this study, please print and sign your name.
I, ____________________________________________, want to be in this research project.

(Print your name here)

______________________________
(Sign your name here)            (Date)
Appendix E: Health History Questionnaire

Child Health History

Child’s Name: ____________________________
Street Number and Name: _________________________________________________
City: __________________________ State: _______________ ZIP: _______
Phones: Home _____________ Work _______________ Cell __________________
E-mail Address: _________________________________________________________

1) Has a physician ever told you that your child has any of the following: (Check YES or NO)

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
<th>If yes, explain:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>High Blood Pressure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diabetes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Epilepsy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Asthma</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heart Disease</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other</td>
</tr>
</tbody>
</table>

2) Is your child currently taking any medications? (circle one)  YES  NO
(include vitamins, herbal remedies, over-the-counter medicine, prescriptions medicine, etc.)

<table>
<thead>
<tr>
<th>Medication</th>
<th>Purpose</th>
<th>How Much</th>
<th>How Often</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>
3) Is your child able to take part in all physical education activities and recess at school?

______ Yes, all activities   _____ No (Please explain)

4) Do you know of any reason why your child should not take part in exercise at school or in after-school programs?

______ No       _____ Yes (Please explain)

Parent/Guardian Name: ____________________________________________

Parent/Guardian Signature: _________________________________________

Relationship to child: ___________________________ Date: ______________

Do Not Write in this Box

<table>
<thead>
<tr>
<th>Information Confirmed:</th>
<th>Yes</th>
<th>No</th>
<th>Contact Method:</th>
<th>Phone</th>
<th>Email</th>
<th>Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Representative:</td>
<td></td>
<td></td>
<td>Date: __________</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signature:</td>
<td></td>
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</tbody>
</table>
Appendix F: Modified School Physical Activity and Nutrition Parent Survey

17. Please give your answers on the basis of your child’s behavior over the last 6 months.

<table>
<thead>
<tr>
<th>(Fill in one answer for each behavior)</th>
<th>Not True</th>
<th>Somewhat True</th>
<th>Certainly True</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Considerate of other people’s feelings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Restless, overactive; cannot stay still for long</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Often complains of headaches, stomachaches, or sickness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Shares readily with other children, for example toys, treats, or pencils</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Often loses temper</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Rather solitary, prefers to play alone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Generally well-behaved, usually does what adults request</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h. Many worries or often seems worried</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. Helpful if someone is hurt, upset, or feeling ill</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>j. Constantly fidgeting or squirming</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>k. Has at least one good friend</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>l. Often fights with other children or bullies them</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>m. Often unhappy, depressed, or tearful</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n. Generally liked by other children</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o. Easily distracted; concentration wanders</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p. Nervous or clingy in new situations; easily loses confidence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>q. Kind to younger children</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>r. Often lies or cheats</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>s. Picked on or bullied by other children</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t. Often offers to help others (parents, teachers, other children)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>u. Thinks things out before acting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>v. Steals from home, school, or elsewhere</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>w. Gets along better with adults than with other children</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x. Many fears; easily scared</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>y. Good attention span; sees chores or homework through to the end</td>
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<td></td>
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</tbody>
</table>

18. On most days what does your child usually do when she or he has a choice about how to spend leisure/free time?
- ☐ Almost always chooses activities like TV, reading, listening to music, computers, or video games
- ☐ Usually chooses activities like TV, reading, listening to music, computers, or video games
- ☐ Just as likely to choose active as inactive activities
- ☐ Usually chooses activities like bicycling, dancing, outdoor games, or active sports
- ☐ Almost always chooses activities like bicycling, dancing, outdoor games, or active sports

19. How often does your child have difficulties in the following areas?

<table>
<thead>
<tr>
<th>(Fill in only one answer for each)</th>
<th>Not at All</th>
<th>Only a Little</th>
<th>Quite a Lot</th>
<th>A Great Deal</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Home Life</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Friendships</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Classroom Learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Leisure Activities/ Free Time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

62. How many hours of sleep do you normally get a night on a weekday?
- 5 hours or less
- 6 hours
- 7 hours
- 8 hours
- 9 hours or more

63. How many hours of sleep do you normally get a night on the weekend?
- 5 hours or less
- 6 hours
- 7 hours
- 8 hours
- 9 hours or more

64. In your neighborhood, how much of a problem are the things listed below?

<table>
<thead>
<tr>
<th>(Fill in one answer for each question)</th>
<th>Not a Problem</th>
<th>Minor Problem</th>
<th>Somewhat Serious Problem</th>
<th>Very Serious Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Crime in the neighborhood</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Gangs</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>c. Walking or riding a bike (sidewalks, high traffic, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>d. Too much noise</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Trash and litter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Lighting at night (such as street lights, etc.)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Availability of public transportation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h. Prejudice and discrimination</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. Drugs (such as needles in parks, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>j. Stray or dangerous animals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>k. Availability of safe parks, playgrounds, community centers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>l. Access to healthy food</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

65. Which of the following systems do you own in your home? (mark all that apply)
- ☐ Nintendo®
- ☐ Sega®
- ☐ Wii
- ☐ PlayStation®
- ☐ Xbox®
- ☐ Kinect®
- ☐ GameBoy®
- ☐ Other ____________

Thank you for your participation.

Appendix G: Modified School Physical Activity and Nutrition Child Survey

Subject ID: T H

Teaching HENRY Study
STUDENT SURVEY

The following questions are about what students your age eat, what they know about nutrition, and their physical activity (exercise). Your answers will help us learn about students in Ohio and will be used to design better health programs. We will read each question for you and you will pick the answer that is true for you. Mark that answer on your sheet as shown in the example below. This is not a test, and there are no right or wrong answers. Remember, your answers will be kept private.

1. What school do you go to?__________________________

2. Bubble in today’s date.

☐ Jan 1/01-02/09 ☐ 2009
☐ Feb 03/01-04/09 ☐ 2010
☐ Mar 05/01-06/09 ☐ 2011
☐ Apr 07/01-08/09 ☐ 2012
☐ May 09/01-10/09 ☐ 2013
☐ Jun 11/01-12/09 ☐ 2014
☐ Jul 13/01-14/09 ☐ 2015
☐ Aug 15/01-16/09
☐ Sep 17/01-18/09
☐ Oct 19/01-20/09
☐ Nov 21/01-22/09
☐ Dec 23/01-24/09


☐ 8
☐ 9
☐ 10
☐ 11
☐ 12

4. Are you a boy or girl?

☐ Boy
☐ Girl

5. What language do you use with your parents most of the time? (Fill in only one)

☐ English
☐ Spanish
☐ Other__________________________

(Write in other language)

6. How do you describe yourself? (Fill in only one)

☐ Black or African-American
☐ Mexican-American, Latino, or Hispanic
☐ White, Caucasian, or Anglo
☐ Vietnamese
☐ Chinese
☐ Indian or Pakistani
☐ Other Asian
☐ American Indian or Alaska Native
☐ Native Hawaiian or Other Pacific Islander
☐ Other__________________________

(Write in other)

13. Yesterday did you eat yogurt or drink a yogurt drink? Do not count frozen yogurt.
- No, I didn’t eat any of the foods listed above yesterday.
- Yes, I ate one of these foods 1 time yesterday.
- Yes, I ate one of these foods 2 times yesterday.
- Yes, I ate one of these foods 3 or more times yesterday.

14. Yesterday, did you eat any rice, faro, macaroni, spaghetti, or pasta noodles that were white?
- No, I didn’t eat any of the foods listed above yesterday.
- Yes, I ate one of these foods 1 time yesterday.
- Yes, I ate one of these foods 2 times yesterday.
- Yes, I ate one of these foods 3 or more times yesterday.

15. Yesterday, did you eat any rice, faro, macaroni, spaghetti, or pasta noodles that were brown?
- No, I didn’t eat any of the foods listed above yesterday.
- Yes, I ate one of these foods 1 time yesterday.
- Yes, I ate one of these foods 2 times yesterday.
- Yes, I ate one of these foods 3 or more times yesterday.

16. Yesterday, did you eat any bread, tortillas, buns, bagels, or rolls that were white?
- No, I didn’t eat any of the foods listed above yesterday.
- Yes, I ate one of these foods 1 time yesterday.
- Yes, I ate one of these foods 2 times yesterday.
- Yes, I ate one of these foods 3 or more times yesterday.

17. Yesterday, did you eat any bread, tortillas, buns, bagels, or rolls that were brown?
- No, I didn’t eat any of the foods listed above yesterday.
- Yes, I ate one of these foods 1 time yesterday.
- Yes, I ate one of these foods 2 times yesterday.
- Yes, I ate one of these foods 3 or more times yesterday.

18. Yesterday, did you eat any hot or cold cereal?
- No, I didn’t eat any cereal yesterday.
- Yes, I ate cereal 1 time yesterday.
- Yes, I ate cereal 2 times yesterday.
- Yes, I ate cereal 3 or more times yesterday.

19. Yesterday, did you eat French fries or chips?
- Chips are potato chips, tortilla chips, Cheetos®, corn chips, or other snack chips.
- No, I didn’t eat any of the foods listed above yesterday.
- Yes, I ate one of these foods 1 time yesterday.
- Yes, I ate one of these foods 2 times yesterday.
- Yes, I ate one of these foods 3 or more times yesterday.

25. Yesterday, did you eat fruit? Fruits are all fresh, frozen, canned or dried fruits. Do not count fruit juice.
   - No, I didn’t eat any fruit yesterday.
   - Yes, I ate fruit 1 time yesterday.
   - Yes, I ate fruit 2 times yesterday.
   - Yes, I ate fruit 3 times yesterday.
   - Yes, I ate fruit 4 times yesterday.
   - Yes, I ate fruit 5 or more times yesterday.

26. Yesterday, did you drink fruit juice? Fruit juice is a drink, which is 100% juice, like orange juice, apple juice or grape juice. Do not count punch, Kool-Aid®, sports drinks, or other fruit-flavored drinks.
   - No, I didn’t drink any fruit juice yesterday.
   - Yes, I drank fruit juice 1 time yesterday.
   - Yes, I drank fruit juice 2 times yesterday.
   - Yes, I drank fruit juice 3 or more times yesterday.

27. Yesterday, did you drink any punch, Kool-Aid®, sports drink, or other fruit-flavored drinks? Do not count 100% fruit juice.
   - No, I didn’t drink any of these drinks yesterday.
   - Yes, I drank one of these drinks 1 time yesterday.
   - Yes, I drank one of these drinks 2 times yesterday.
   - Yes, I drank one of these drinks 3 or more times yesterday.

28. Yesterday, did you drink any regular (not diet) sodas or soft drinks?
   - No, I didn’t drink any regular (not diet) sodas or soft drinks yesterday.
   - Yes, I drank regular (not diet) sodas or soft drinks 1 time yesterday.
   - Yes, I drank regular (not diet) sodas or soft drinks 2 times yesterday.
   - Yes, I drank regular (not diet) sodas or soft drinks 3 or more times yesterday.

29. Yesterday, did you drink any diet sodas or soft drinks?
   - No, I didn’t drink any diet sodas or soft drinks yesterday.
   - Yes, I drank diet sodas or soft drinks 1 time yesterday.
   - Yes, I drank diet sodas or soft drinks 2 times yesterday.
   - Yes, I drank diet sodas or soft drinks 3 or more times yesterday.

30. Yesterday, did you eat a frozen dessert? A frozen dessert is a cold, sweet food like ice cream, frozen yogurt, an ice cream bar, or a Popsicle®.
   - No, I didn’t eat any frozen dessert yesterday.
   - Yes, I ate a frozen dessert 1 time yesterday.
   - Yes, I ate a frozen dessert 2 times yesterday.
   - Yes, I ate a frozen dessert 3 or more times yesterday.

31. Yesterday, did you eat sweet rolls, doughnuts, cookies, brownies, pies, or cake?
   - No, I didn’t eat any of the foods listed above yesterday.
   - Yes, I ate one of these foods 1 time yesterday.
   - Yes, I ate one of these foods 2 times yesterday.
   - Yes, I ate one of these foods 3 or more times yesterday.

32. Yesterday, did you eat any candy? Count chewy, gummy, hard, or chocolate candy. Do not count brownies, chocolate cookies, or gum.
   - No, I didn’t eat any candy yesterday.
   - Yes, I ate candy 1 time yesterday.
   - Yes, I ate candy 2 times yesterday.
   - Yes, I ate candy 3 or more times yesterday.

33. Yesterday, did you eat breakfast?
   - No, I didn’t eat breakfast yesterday.
   - Yes, I ate breakfast at home yesterday.
   - Yes, I ate breakfast at school yesterday.
   - Yes, I ate breakfast at home and school yesterday.
   - Yes, I ate breakfast somewhere other than home or school yesterday.

34. Yesterday, did you eat an evening meal?
   - No, I didn’t eat an evening meal yesterday.
   - Yes, I ate an evening meal at home yesterday.
   - Yes, I ate an evening meal at a fast food restaurant yesterday.
   - Yes, I ate an evening meal at a sit-down restaurant yesterday.
   - Yes, I ate an evening meal at a pizza place yesterday.
   - Yes, I ate an evening meal other than at home, a sit-down restaurant or a fast food restaurant yesterday.

35. Yesterday, how many times did you eat food from any type of restaurant? Restaurants include fast food, sit down restaurants, pizza places, and cafeterias. Do not count school cafeterias.
   - None
   - 1 time
   - 2 times
   - 3 or more times

36. Yesterday, how many times did you eat outside your home? Do NOT include restaurants or school cafeterias.
   - None
   - 1 time
   - 2 times
   - 3 or more times

37. Last week, on which days did you exercise or take part in physical activity that made your heart beat fast and made you breathe hard for at least 60 minutes total?
   - I didn’t do any exercise last week that made my heart beat fast for 60 minutes.
   - Monday
   - Tuesday
   - Wednesday
   - Thursday
   - Friday
   - Saturday
   - Sunday

38. Last week, on which days did you play outdoors for 60 minutes or more? *Do not count* during school hours.
- [ ] I didn’t play outdoors last week.
- [ ] Monday
- [ ] Tuesday
- [ ] Wednesday
- [ ] Thursday
- [ ] Friday
- [ ] Saturday
- [ ] Sunday

39. During the past 12 months, on how many sports teams did you play? Sports teams include soccer, basketball, baseball, softball, swimming, gymnastics, cheerleading, wrestling, track, football, dance, tennis, and volleyball. *Do not include* PE classes.
- [ ] 0 teams
- [ ] 1 team
- [ ] 2 teams
- [ ] 3 or more teams

40. Do you currently take part in any other organized physical activities or take lessons, such as martial arts, dance, gymnastics, or tennis?
- [ ] Yes
- [ ] No

41. How much exercise should children get most days of the week to be healthy?
- [ ] 20 minutes a day
- [ ] 30 minutes a day
- [ ] 40 minutes a day
- [ ] 60 minutes a day
- [ ] I don’t know how much they should get every day

42. How safe do you feel at school?
- [ ] Not safe
- [ ] A little safe
- [ ] Somewhat safe
- [ ] Mostly safe
- [ ] Very safe

43. During the last week, have others...
   a. ... made fun of or insulted you?
      - [ ] Never
      - [ ] 1 time
      - [ ] 2 or 3 times
      - [ ] Almost every day
      - [ ] Every day
   
   b. ... attacked or ill-treated you?
      - [ ] Never
      - [ ] 1 time
      - [ ] 2 or 3 times
      - [ ] Almost every day
      - [ ] Every day
   
   c. ... excluded you intentionally or prevented you from participation?
      - [ ] Never
      - [ ] 1 time
      - [ ] 2 or 3 times
      - [ ] Almost every day
      - [ ] Every day

44. Over the last 6 months, how often have you been bullied at school? (A student is being bullied when another student, or a group of students, say or do nasty and unpleasant things to him or her. It is also bullying when a student is teased repeatedly in a way he or she doesn't like.)

<table>
<thead>
<tr>
<th>Option</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>I haven't been bullied at school over the last 6 months</td>
<td>About once a week</td>
</tr>
<tr>
<td>It has only happened once or twice</td>
<td>Several times a week</td>
</tr>
<tr>
<td>2 or 3 times a month</td>
<td></td>
</tr>
</tbody>
</table>

45. On most days, how do you arrive at school?

<table>
<thead>
<tr>
<th>Option</th>
<th>Method of Transportation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk</td>
<td>School bus</td>
</tr>
<tr>
<td>Bike</td>
<td>City bus</td>
</tr>
<tr>
<td>Family car with only your family</td>
<td>Carpool with children from other families</td>
</tr>
</tbody>
</table>

46. How sure are you that you can play outside after school instead of watching TV?

<table>
<thead>
<tr>
<th>Option</th>
<th>Certainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not sure</td>
<td>A little sure</td>
</tr>
</tbody>
</table>

47. How sure are you that you can make healthy choices?

<table>
<thead>
<tr>
<th>Option</th>
<th>Certainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not sure</td>
<td>A little sure</td>
</tr>
</tbody>
</table>

48. How sure are you that you can eat a piece of fruit as a snack instead of candy?

<table>
<thead>
<tr>
<th>Option</th>
<th>Certainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not sure</td>
<td>A little sure</td>
</tr>
</tbody>
</table>

49. On most school days, how many hours do you watch TV, DVDs or movies away from school?

<table>
<thead>
<tr>
<th>Option</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don't watch TV, DVDs or movies</td>
<td>3 hours</td>
</tr>
<tr>
<td>Less than 1 hour</td>
<td>4 hours</td>
</tr>
<tr>
<td>1 hour</td>
<td>5 hours</td>
</tr>
<tr>
<td>2 hours</td>
<td>6 hours or more</td>
</tr>
</tbody>
</table>

50. On most school days, how many hours per day do you usually spend on a computer away from school? (Time on the computer includes time spent surfing the Internet, instant messaging, and playing online video games or computer games)

<table>
<thead>
<tr>
<th>Option</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don't use a computer</td>
<td>3 hours</td>
</tr>
<tr>
<td>Less than 1 hour</td>
<td>4 hours</td>
</tr>
<tr>
<td>1 hour</td>
<td>5 hours</td>
</tr>
<tr>
<td>2 hours</td>
<td>6 hours or more</td>
</tr>
</tbody>
</table>

51. On most school days, how many hours per day do you usually spend playing video games like Nintendo®, Wii or DS, Sega®, PlayStation®, Xbox®, GameBoy® or arcade games away from school?

<table>
<thead>
<tr>
<th>Option</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don't play video games</td>
<td>3 hours</td>
</tr>
<tr>
<td>Less than 1 hour</td>
<td>4 hours</td>
</tr>
<tr>
<td>1 hour</td>
<td>5 hours</td>
</tr>
<tr>
<td>2 hours</td>
<td>6 hours or more</td>
</tr>
</tbody>
</table>

52. How often do you read the nutrition labels on food packages?

<table>
<thead>
<tr>
<th>Option</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almost always or always</td>
<td>Sometimes</td>
</tr>
</tbody>
</table>

53. What are you trying to do about your weight?  
☐ Lose weight  ☐ Gain weight  ☐ Stay the same weight  ☐ Nothing

54. Compared to other students in your grade who are as tall as you, do you think you weigh:  
☐ Too much  ☐ The right amount  ☐ Too little (or not enough)

55. How many total cups of fruits should you eat each day?  
☐ At least 2  ☐ At least 3  ☐ At least 4  ☐ At least 5  ☐ I don’t know

56. How many total cups of vegetables should you eat each day?  
☐ At least 2  ☐ At least 3  ☐ At least 4  ☐ At least 5  ☐ I don’t know

57. How much of your bread and cereal should be whole grains (brown, whole wheat, etc.)?  
☐ None  ☐ Some  ☐ About half  ☐ Most  ☐ I don’t know

58. How many minutes of physical activity should you have most days of the week?  
☐ Less than 20 minutes  ☐ 30 minutes  ☐ 50 minutes  ☐ I don’t know  
☐ 20 minutes  ☐ 45 minutes  ☐ 60 minutes

59. If I eat healthy foods most of the time, I will have fewer health problems.  
☐ Agree  ☐ In between  ☐ Disagree

60. I am sure that I can read and understand a food label on most of my foods at home  
☐ Agree  ☐ In between  ☐ Disagree

61. If I run and play every day, I will have fewer health problems.  
☐ Agree  ☐ In between  ☐ Disagree

62. If I am overweight I am more likely to have more health problems like cancer or heart disease.  
☐ Agree  ☐ In between  ☐ Disagree

63. Healthy foods taste good.  
☐ Almost always or always  ☐ Sometimes  ☐ Almost never or never

64. Do you eat school lunches?  
☐ Almost always or always  ☐ Sometimes  ☐ Almost never or never

65. Around your home, within walking distance, which do you have that you can play in when school is closed?  
☐ Yard  ☐ Park  ☐ Playground  ☐ Walking Path/Sidewalks  ☐ Recreation Center

66. I think the lunch served in my school cafeteria is healthy.  
☐ Almost always or always  ☐ Sometimes  ☐ Almost never or never

Appendix H: Healthy Food Knowledge Activity (Script, Pictures)

Script for Children’s Healthy Food Knowledge Activity:
Introduction:
Hi, my name is (researcher name) and I am conducting a research project about healthy food and activities. First, I want to find out which foods you think are healthy and which foods you think are unhealthy. You will be taking part in a special activity. You will need to help me sort through some photos of foods, and tell me whether you think they are healthy or unhealthy. Would you like to help me? If you feel uncomfortable, you can stop whenever you want. If child says yes, continue.
Make sure children are comfortable.

Can you tell me what healthy means?
Correct child response: “Something that is good for you.”
If correct: Yes that is right; it is food that is good for you and that you should eat a lot of the time.
If incorrect: Healthy food means food that is good for you and that you should eat a lot of the time.

Can you tell me what unhealthy means?
Correct child response: “Something that is not good for you.”
If correct: Yes that is right; it is food that is not good for you and you should only eat sometimes.
If incorrect: Unhealthy food means food that is not good for you and you should only eat sometimes.

Explain the activity to the child:
I have 20 pictures of different foods. I will show you one photo at a time and ask you some questions about the food.
1. First, I will ask you to tell me the name of the food in the photo.
2. Second, I will ask you to tell me if you think the food is healthy or unhealthy.
3. Then I will ask you to place the photo of the food next to the green checkmark or the red ‘x’. If you think the food is healthy you need to place it next to the green checkmark. If you think the food is unhealthy you need to place it next to the big ‘x’. If you do not know the answer you can put the photo next to the question mark. But only put the food next to the question mark if you really don’t know the answer. Give it a go, it is okay if you don’t put anything next to the question mark. We will do this for every photo.

Do you have any questions about the game?
Are you ready to play?
This is the first photo (pick up photo number 1 and pass to the child).

Can you tell me the name of this food?
(Record the child’s response - record name given for the food)
If correct: Well done/good/yes that is correct.
If incorrect: Tell the child what the food is called.

Do you think this food goes with the red X (unhealthy), the green checkmark (healthy), or are you unsure?
(Record the child’s response)
Continue with one photo at a time until they have completed all the photos. Record results on score sheet while the child is completing the task.

Now I have 10 pictures of different activities. I will show you one photo at a time and ask you some questions about the activity.

1. First, I will ask you to tell me the name of the activity in the photo.
2. Second, I will ask you to tell me if you think the activity is active or inactive.
3. Then I will ask you to place the photo of the activity next to the green checkmark or the red ‘x’. If you think the activity is active you need to place it next to the green checkmark. If you think the activity is inactive you need to place it next to the big ‘x’. If you do not know the answer you can put the photo next to the question mark. But only put the activity next to the question mark if you really don’t know the answer. Give it a go, it is okay if you don’t put anything next to the question mark. We will do this for every photo.

Can you tell me what active means?
Correct child response: “Something where you are moving.”
If correct: Yes that is right; it is an activity that requires you to be moving.
If incorrect: Being active means your body is moving.

Can you tell me what inactive means?
Correct child response: “Something where you are not moving.”
If correct: Yes that is right; it is an activity where you are not moving.
If incorrect: Being inactive means that you are not moving.

Can you tell me the name of this activity?
(Record the child’s response - record name given for the activity)
If correct: Well done/good/yes that is correct.
If incorrect: Tell the child what the food is called.

Do you think this activity goes with the red X (inactive), the green checkmark (active), or are you unsure?
(Record the child’s response)
Continue with one photo at a time until they have completed all the photos. Record results on score sheet while the child is completing the task.

Thank you for helping me with this activity!

## Appendix I: Survey Question Scoring, Scales, and Items

<table>
<thead>
<tr>
<th>Category</th>
<th>Question</th>
<th>Topic</th>
<th>Items</th>
<th>Scale</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA Knowledge</td>
<td>SPAN 41</td>
<td>How much exercise should children get</td>
<td>5</td>
<td>From 20 to 60 min/day, including “I don’t know”</td>
<td>0-4</td>
</tr>
<tr>
<td></td>
<td>SPAN 58</td>
<td>How much PA you should get</td>
<td>7</td>
<td>From &lt; 20 to 60 min/day, including “I don’t know”</td>
<td>0-5</td>
</tr>
<tr>
<td></td>
<td>SPAN 61</td>
<td>Playing leads to fewer health problems</td>
<td>3</td>
<td>Disagree-Agree</td>
<td>0-2</td>
</tr>
<tr>
<td></td>
<td>SPAN 62</td>
<td>Overweight leads to more health problems</td>
<td>3</td>
<td>Disagree-Agree</td>
<td>0-2</td>
</tr>
<tr>
<td></td>
<td>HFKA 1</td>
<td>Running</td>
<td>3</td>
<td>Correct/Incorrect</td>
<td>0-1</td>
</tr>
<tr>
<td></td>
<td>HFKA 2</td>
<td>Television</td>
<td>3</td>
<td>Correct/Incorrect</td>
<td>0-1</td>
</tr>
<tr>
<td></td>
<td>HFKA 3</td>
<td>Reading</td>
<td>3</td>
<td>Correct/Incorrect</td>
<td>0-1</td>
</tr>
<tr>
<td></td>
<td>HFKA 4</td>
<td>Video Games</td>
<td>3</td>
<td>Correct/Incorrect</td>
<td>0-1</td>
</tr>
<tr>
<td></td>
<td>HFKA 5</td>
<td>Jump-Rope</td>
<td>3</td>
<td>Correct/Incorrect</td>
<td>0-1</td>
</tr>
<tr>
<td></td>
<td>HFKA 6</td>
<td>Sleeping</td>
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<td>Correct/Incorrect</td>
<td>0-1</td>
</tr>
<tr>
<td></td>
<td>HFKA 7</td>
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<td>3</td>
<td>Correct/Incorrect</td>
<td>0-1</td>
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<tr>
<td></td>
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<td>Bicycling</td>
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<td>0-1</td>
</tr>
<tr>
<td></td>
<td>HFKA 9</td>
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<td>0-1</td>
</tr>
<tr>
<td></td>
<td>HFKA 10</td>
<td>Computer</td>
<td>3</td>
<td>Correct/Incorrect</td>
<td>0-1</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>SPAN 46</td>
<td>Playing outside instead of TV</td>
<td>3</td>
<td>Not-Very sure</td>
<td>0-2</td>
</tr>
<tr>
<td></td>
<td>SPAN 47</td>
<td>Making healthy choices</td>
<td>3</td>
<td>Not-Very sure</td>
<td>0-2</td>
</tr>
<tr>
<td>Self-Reported</td>
<td>SPAN 37</td>
<td>Days 60 min PA</td>
<td>8</td>
<td>Days in a week</td>
<td>0-7</td>
</tr>
<tr>
<td>PA</td>
<td>SPAN 38</td>
<td>Days playing outside 60 min</td>
<td>8</td>
<td>Days in a week</td>
<td>0-7</td>
</tr>
<tr>
<td></td>
<td>SPAN 39</td>
<td>Number of sports teams over last year</td>
<td>4</td>
<td>None-3 or more</td>
<td>0-3</td>
</tr>
<tr>
<td></td>
<td>SPAN 40</td>
<td>Other organized sports</td>
<td>2</td>
<td>Yes/No</td>
<td>0-1</td>
</tr>
<tr>
<td></td>
<td>SPAN 45</td>
<td>School transport</td>
<td>6</td>
<td>Transport options, scored 1 = active</td>
<td>0-1</td>
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<tr>
<td>Self-Reported</td>
<td>SPAN 49</td>
<td>Television</td>
<td>8</td>
<td>Hours/weekday, min “none,” then “less than one hr” to “6 or more”</td>
<td>0-6</td>
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<tr>
<td>SB</td>
<td>SPAN 50</td>
<td>Computer</td>
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<td>“none,” then “less than one hr” to “6 or more”</td>
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<tr>
<td></td>
<td>SPAN 51</td>
<td>Video Games</td>
<td>8</td>
<td>“none,” then “less than one hr” to “6 or more”</td>
<td>0-6</td>
</tr>
</tbody>
</table>
Appendix J: Activity Monitor Log

Teaching HENRY

ACTIVITY MONITOR LOG

ID: TH

Date: ________________

☐ Baseline

☐ Follow up

Ohio University
Glazer Center E344
(740) 593 - 2888
hawes@ohio.edu

Remember, take your activity monitor off when you shower or bathe. Otherwise, wear it over your right hip. Use the elastic band to fit it tight enough so it doesn’t move too much. If it hurts or bothers you, ask someone to help you adjust it or wear it over your clothing!

<table>
<thead>
<tr>
<th>Day</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Taken Off</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reason Taken Off</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time Put Back On</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time Taken Off</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reason Taken Off</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time Put Back On</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
### Appendix K: Lesson, Homework, and Activity Descriptions

#### Lesson 1

<table>
<thead>
<tr>
<th>Topic</th>
<th>Henry Gets Moving!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Objective</td>
<td>Children will understand major plot points and relate to the characters and events in the book</td>
</tr>
<tr>
<td>Activity</td>
<td>Small group reading and discussion of the book <em>Henry Gets Moving!</em></td>
</tr>
<tr>
<td>Homework</td>
<td>Read the book at home with their parents/family</td>
</tr>
</tbody>
</table>

#### Lesson 2

<table>
<thead>
<tr>
<th>Topic</th>
<th>Physical Activity/Sedentary Behavior Effects and Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Objective</td>
<td>Children will know the recommended dose of daily physical activity, understand benefits of activity, and too much behavior could be detrimental to health</td>
</tr>
<tr>
<td>Activity</td>
<td>Picture-based discussion, with activity breaks every 2-3 min</td>
</tr>
<tr>
<td>Homework</td>
<td>Activity log where they color in one square/10 min of activity</td>
</tr>
</tbody>
</table>

#### Lesson 3

<table>
<thead>
<tr>
<th>Topic</th>
<th>Five Food Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Objective</td>
<td>Purpose of and identification of groups, best choices in each group, like lean meats, whole grains, unprocessed and unsweetened foods</td>
</tr>
<tr>
<td>Activity</td>
<td>Picture-based discussion, then hands-on activity making a healthy snack (homemade salsa)</td>
</tr>
<tr>
<td>Homework</td>
<td>Coloring/matching activity worksheet</td>
</tr>
</tbody>
</table>

#### Lesson 4

<table>
<thead>
<tr>
<th>Topic</th>
<th>Activity Intensities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Objective</td>
<td>Children should be able to differentiate between sedentary and moderate-to-vigorous activities</td>
</tr>
<tr>
<td>Activity</td>
<td>Hands-on experience with activities of different intensities, such as sitting, walking, playing games</td>
</tr>
<tr>
<td>Homework</td>
<td>Physical Activity log</td>
</tr>
</tbody>
</table>

#### Lesson 5

<table>
<thead>
<tr>
<th>Topic</th>
<th>MyPlate model and general portion sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Objective</td>
<td>Half of your plate should be fruits and vegetables, choose whole grains, lean meats, etc.</td>
</tr>
<tr>
<td>Activity</td>
<td>Craft activity for each child to cut out foods, color, and paste on to their own MyPlate</td>
</tr>
<tr>
<td>Homework</td>
<td>Children draw their dinner on a MyPlate</td>
</tr>
</tbody>
</table>

#### Lesson 6

<table>
<thead>
<tr>
<th>Topic</th>
<th>Review of Major Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Objective</td>
<td>To review previous objectives and plot of <em>Henry Gets Moving!</em></td>
</tr>
<tr>
<td>Activity</td>
<td>Children move around 6 stations and get their “passport” stamped upon completion of a hands-on group activity</td>
</tr>
</tbody>
</table>
Appendix L: Henry Gets Moving!

Henry Gets Moving!
© 2012 Henry Gets Moving, LLC. All Rights Reserved.

Written by: Pierre Bouvier M.D. and Chas Nielsen
Illustrated by: Casarotta/Leeb

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It was moving day for Henry! He said goodbye to his friends and drove away with his parents. He was excited to see their new home.

Era el día de mudanza de Henry! Henry dijo adiós a sus amigos y se dirigió con sus padres.

But when he got there, he felt sad and lonely. Henry didn’t have any new friends yet, and it didn’t start for a long time. Henry was bored.

Pero cuando llegó, se sintió triste y solo. Henry no tenía amigos nuevos y no comenzó para mucho tiempo. Henry estaba aburrido.

He didn’t know any other kids, so he spent a lot of time inside playing video games and eating his favorite foods. They made him feel good.

No conocía a otros niños, por lo que pasaba mucho tiempo en casa jugando videojuegos y comiendo sus comidas favoritas. Le hacía sentir mejor.

Well sometimes they made him feel good. Bueno, a veces lo hacían sentir mejor.

Sometimes they made him feel awful. Otras veces, lo hacían sentir muy mal.

Finally, school started. To Henry’s surprise, there was another kid in the neighborhood. Finalmente, la escuela comenzó. Para sorpresa de Henry, había otro niño en el barrio.

"Hi, I’m Jasper! You must be the new kid. What’s your name?" "Hola, soy Jasper! Tú must be el niño nuevo. ¿Cómo te llamas?"

In art class, he couldn’t think of anything to paint. En clase de arte, no pensaba en nada para dibujar.

Copyright 2012 by Henry Gets Moving, LLC. Reprinted with permission.
During recess, kids picked teams for a game of kickball. During el recreo, los niños eligieron equipos para un juego de béisbol.

Henry got picked last. Henry fue el último en ser elegido.

"Sometimes, your friend is too slow. I don’t think he should play with us anymore.”" A veces, un amigo es demasiado lento. No creo que deba jugar con nosotros.

Henry felt terrible. Henry se sintió terrible.

Henry: "You’re not going to eat it, are you?" "You’re not going to eat it, are you?" "No lo voy a comer, ¿verdad?"

"Well, what do you like to do after school?" "What are you going to do after school?"

"I like to play video games, I like soccer too, but I am tired early. And I want to take a nap at the end of the school year with the other kids."

"No juego vídeo juegos y fútbol, pero me canso temprano. Y quiero tomar un descanso al final del año con los otros niños."

Henry and Jasmine sat together at lunch time. Henry y Jasmine se sentaron juntos al almuerzo.

Jasmine said:

- A turkey sandwich, un sándwich de pollo.
- French fries, papas fritas.
- Chocolate chip cookies, galletas de chocolate.
- And a soda, una coca.

Henry said: un perro, un perro, galletas de chocolate y coca.

"Henry, what do you like to eat?" asked Dr. Harwell. "Henry, ¿qué te gusta comer?" preguntó Dr. Harwell.

"On top of things! o y más cosas..." dijo Henry.
"Mom, are you listening? Henry will need your help too."
"Sí, mamá, está bien, ¡Ayúdame! Henry necesita tu ayuda también!"

The next day, Henry's mom suggested they drive to the park to meet Jasmine. Al día siguiente, mamá de Henry sugirió que conducieran al parque con Jasmine.

"Let's walk, instead. Remember, mom, Dr. Hartwell said it's important for you and dad to get moving, too."
"Vamos caminando, mamá. Dr. Hartwell nos dijo que es importante que tú y papá también se ejerciten."
Henry’s parents had lots of fun playing with the kids.

Los padres de Henry también se divirtieron con los niños.

“Isn’t it great to be outside and moving!” Henry’s Dad said.

“¡Qué bien que estén al aire libre y caminando!” dijo el padre de Henry.

Dr. Hartwell was very impressed with Henry returned in the spring.

Dr. Hartwell estaba muy impresionado con Henry cuando volvió en primavera.

“Henry, you look SO happy, healthy, and strong!”

“¡Henry, estás tan feliz, fuerte y saludable!”

“We’re all doing better now we started eating healthy and exercising!” Henry’s mom said.

“Estamos haciendo mejor ahora que empezamos a comer saludable y hacer ejercicios,” dijo la mamá de Henry.

“When you need Not Moving I can!” Henry smiled.

“Cuando necesites moverme puedo, ¿eh?” sonrió Henry.

“Hey boys, you know what this means?” Charlie jeered.

“Hey boys, sabes lo que esto significa?” Charlie rió.

“I think it’s time for me to go home!”

“Creo que es hora de que me vaya a casa!”