12-14-2018

# Health Science Curriculum for Early Childhood: Teacher Implementation and Impact on Child Health Knowledge

Carla J. Mays

# Health science curriculum for early childhood: Teacher implementation and impact on child health knowledge

By

Carla Mays

A Dissertation
Submitted to the Faculty of
Mississippi State University
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy
in Human Development & Family Science
in the Department of Human Sciences

Mississippi State, Mississippi

December 2018

Health science curriculum for early childhood: Teacher implementation and impact on child health knowledge

By

Carla Mays

Approved:

______________________________
Lori Elmore-Staton
(Director of Dissertation)

______________________________
Julie Parker
(Committee Member)

______________________________
Donna Peterson
(Committee Member)

______________________________
Angel Herring
(Committee Member)

______________________________
Tommy Phillips
(Graduate Coordinator)

______________________________
George Hopper
Dean
College of Agriculture and Life Sciences

Name: Carla Mays

Date of Degree: December 14, 2018

Institution: Mississippi State University

Major Field: Human Development & Family Science

Major Professor: Dr. Lori Elmore-Staton

Title of Study: Health science curriculum for early childhood: Teacher implementation and impact on child health knowledge

Pages in Study 92

Candidate for Degree of Doctor of Philosophy

This dissertation contains two secondary quantitative data analyses studies. In the first, implementation of the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science curriculum was examined to assess the amount of activities within each curriculum domain (i.e., books, creative expressions, language/literacy, math, science) and the number of activities within each theme (i.e., nutrition, physical activity, sleep) utilized by participating teachers. Prior to implementation, teachers ($N$ = 68; $M$ age = 35.5) attended a one-hour training where they were instructed to implement the curriculum over the course of a month and record lessons implemented on a usage checklist. An overall total number of activities and a total number of activities within each curriculum domain (e.g., language/literacy) and theme (e.g., nutrition) was calculated using a frequency analysis. Results show that more than 20% of reporting teachers ($n$ = 10; 21.8%) implemented all or almost all (i.e., 49 or 50 lessons) of the curriculum's 50 activities. Children had more exposure to the book domain and the theme of nutrition, with less engagement in the domain of math and sleep-themed lessons.

The second study examined the association between the dosage of the *WannaBee*

*Healthy?* curriculum implementation within each classroom and child health knowledge outcomes. Explicitly, is the dosage and type of content implementation directly associated with student's gain in knowledge and the ability to identify the following (1) food from the five food groups, (2) a healthy plate, (3) food origins, (4) activities that increase heart rate, and (5) behaviors needed to keep our body healthy. Researchers utilized the information from the usage checklist to determine dosage and content implementation of lessons. Pre- and post-assessments were randomly conducted on 252 pre-kindergarten (17.9%) and kindergarten (82.1%) students (*M* age = 5.02). Pearson correlations identified strong, positive correlations regarding implementation across the curriculum and within the domains and themes. A series of One-way ANOVAs identified significant outcomes of at least one child assessment and in both health themes (i.e., nutrition, physical activity). However, overall findings indicate that curriculum dosage alone was not related to changes in child health knowledge.

ACKNOWLEDGEMENTS

The amount of love and support I have received during this journey is remarkable and no words can begin to express the amount of gratitude I possess. To my family and friends, thank you for the words of encouragement and constant prayers. I am very appreciative of my parents who taught me the value of persistence and hard work, raising me with the attitude that no dream is out of reach. To my children, Lainey and Grayson, thank you for being the ultimate cheerleaders, always boosting my confidence. You two are my inspiration and I love you dearly!

Many thanks to my committee for your guidance, especially to Dr. Lori Elmore-Staton for your expertise and direction. You are much more than an advisor, you are invaluable and without you, I'm not sure I would have been able to finish this. You have become a true friend and I will never forget those three words you wrote to me on a particularly hard day, exactly what I needed to hear……….Just keep swimming. I am truly grateful!

TABLE OF CONTENTS

LIST OF TABLES

# CHAPTER I

# INTRODUCTION

Obesity affects nearly 38% of adults and 17% of children nationwide, increasing the danger of health issues and early death (Trust for America's Health & Robert Wood Johnson Foundation, 2016). Obesity rates are shockingly higher than a generation ago, at twice what they were in 1980, and Americans weigh an average of 24 pounds more than they did in 1960 (Robert Wood Johnson Foundation, 2013). According to the National Institutes of Health, being grossly overweight exacerbates illnesses such as hypertension, cancer, and diabetes and can shorten life expectancy up to 14 years (Kitahara et al., 2014). As the 2016 publication *The State of Obesity: Better Policies for a Healthier America* reports, Mississippi has not escaped the obesity epidemic. It ranks second as the most overweight state where adult obesity rates are presently 35.6%, up from 15.0 % in 1990 and 23.7% in 2000. Similarly, reports from the Supplemental Nutrition Program for Women, Infants, and Children (WIC) show the occurrence of obesity in Mississippi's children aged 2 to 5 at 27.4%, with over 40% of school aged children and youth overweight or obese (Mississippi State Department of Health, 2013). Although the development of becoming overweight and obese occur over time, Puhl and Luedicke (2012) found that obese children tend to become obese adults, indicating the importance of developing healthy habits at an early age.

Obesity, a disorder characterized by having stored excess body fat that increases the risk of both long-term and short-term health problems, develops when more calories are consumed than expended through physical activity (National Institute for Children's Health Quality, 2016). Body mass index (BMI) is commonly used to approximate body fat. An adult's BMI is determined by dividing his or her weight in kilograms (kg) by height squared in meters ($m^2$) (Centers for Disease Control and Prevention, 2016) and BMI ranges from 25 to 29.9 are indicative of overweight and 30 is considered obese (National Institute for Children's Health Quality, 2013). Children's BMI is measured differently, in that boys and girls are compared to other boys and girls of the same age, height, and weight, utilizing a growth chart. If a child or teen has a BMI falling between the $85^{th}$ and $95^{th}$ percentile on the chart, he or she is classified as overweight and if they record at or above the 95th percentile, they are considered obese (National Institute for Children's Health Quality, 2013).

Mississippi children not only struggle with high BMI readings, but also tend to demonstrate increased occurrences of variable risk factors for obesity, including physical inactivity, sleep deprivation, and poor nutrition. As reported in The President's Council on Fitness, Sports and Nutrition (2017), only 1 in 3 American children attain the recommended amount of daily physical activity. The Youth Risk Behavior Survey (Centers for Disease Control and Prevention, 2012) breaks it down further by reporting that only 23.0% of Mississippi youth met the recommended 60 minutes of daily physical activity goal on 7 days prior to taking the survey, and 21.2% of Mississippi youth did not engage in at least 60 minutes of physical activity on any of those days. Additionally, the National Survey of Children's Health (Data Resource Center for Child & Adolescent

Health, 2012) revealed that parents report 44.3% of Mississippi children are not receiving the needed amount of sleep per night as determined by their age. Finally, a deficiency in understanding the value of fruits and vegetables in a child's diet (Liu, 2013) could adversely impact families' abilities to provide nutritious meals, and 40.2% of Mississippi children professed having at least one soda per day for the 7 days leading up to the survey (Centers for Disease Control and Prevention, 2012), illustrating poor dietary choices.

Additionally, home environments have altered significantly in recent years with a larger number of young children receiving primary daytime-care outside of the home (Aud et al., 2012). In fact, 60% of American children, birth to 5 years, are reportedly enrolled in programs an average of 23-27 hours per week (Corcoran & Steinley, 2017), where half to three quarters of their daily energy consumption takes place (Frisvold & Lumeng, 2011). School and early childhood programs offer a variety of opportunities for positive growth development, including unique occasions to influence health-related habits and increase understanding related to obesity issues such as physical activity, sleep, and proper nutrition (Alkon et al., 2014; Lanigan, 2011; Story & Kaphingst, 2009). As more and more children are spending considerable amounts of time in out-of-home care, educators of young children should embrace every chance to offer an environment conducive to maximum impact on future healthy lifestyles (Story & Kaphingst, 2009). This healthy environment could be accomplished through multiple practices such as utilizing a curriculum that integrates obesity-related topics into other lessons throughout the school day, serving an array of nutritious meals and snacks, providing sufficient time to be physical, or allowing for adequate rest according to a child's needs. Given the rising number of children participating in non-custodial care, early childhood programs and kindergartens should be considered an important entity in promoting health-related educational programs.

According to the Institute of Medicine (2012), making healthier choices when it comes to food and physical activity could substantially decrease individual weight and prolong one's life. Unfortunately, habits such as eating and exercising are hard to change after one reaches adulthood (Nicklaus & Remy, 2013; Savage et al., 2007), which highlights the importance of establishing healthy routines at an early age, when habits are forming. Mississippi's Department of Education has attempted to weaken the effects of inferior physical and nutritional practices by requiring all grades, kindergarten through 12, to participate in physical education and by initiating *The Access to Healthy Foods Program* (Mississippi Physical Education Framework, 2006). The United States Congress, also in an effort to increase positive physical and nutrition wellness, developed the Healthy, Hunger-Free Kids Act (HHFKA) in 2010. HHFKA is an initiative designed to provide technical assistance and training to early childhood facilities that participate in the USDA's Child and Adult Care Food Program, which offers meal reimbursement for low-income children enrolled in their facility (USDA, 2017). Even with programs similar to these in place, The National Association for Sport and Physical Education (2010) estimates that by the year 2018, obesity will consume 21% of our nation's total health care costs - $344 billion annually - up from $147 billion in 2008 (Finkelstein et al., 2009). These data, in conjunction with evidence that healthy eating instruction embedded within hands-on learning experiences had a positive impact on dietary awareness and behaviors among primary grade students (Dudley et al., 2015), suggests the importance of creating an effective healthy habits curriculum that is feasible for classroom teachers to incorporate into everyday school lessons, ultimately impacting the wellbeing of future Mississippians and their families.

## Theoretical Perspective

Two guiding theories were identified as the basis of this research study. The first, Bronfenbrenner's Ecological Theory of Human Development (1974), appreciates the impact an environment and experiences have on child growth and development. The second, Vygotsky's Zone of Proximal Development (Schwebel, 1979), values the role that a mentor (e.g., classroom teacher) has to scaffold a child's learning, building on the skills a child has already mastered by offering experiences that build toward new skill mastery. These theories are described below in detail.

Urie Bronfenbrenner's Ecological Theory of Human Development (1994) recognizes the importance of the child, his or her direct and indirect environments, and historical and/or developmental timing of life events on the development of the whole child. The ecological theory consists of five concentric circles, or systems, encasing individuals, to explain how surroundings and relationships play a part in shaping development, including health habits. Each system, although designated with a specific context, moves from the individual at the innermost level (microsystem) to the outermost level (chronosystem) where each interact and influence the other systems through activities that transpire within each setting.

The microsystem, for example, includes occurrences such as social roles and interpersonal exchanges that a young child encounters in face-to-face situations within his or her immediate environment (Bronfenbrenner's, 1974). This level includes interactions at locations such as home, peer groups, and in classrooms. Within the immediate surroundings of the microsystem, children engage in conversations and activities that produce and sustain development through increasingly more complicated interactions with and engagement in the system.

The mesosystem is the second ecological level. It can simply be described as a convergence of microsystems (Bronfenbrenner's, 1994). That is, it is the connection taking place amid two or more settings that contains the child. For example, parents who are involved in their child's education through communication with teachers and extension of school lessons at home through homework or activity booklets are good examples of interactions between two microsystems. Both settings (i.e., home, school), contain the child, and the interaction between the two settings contributes to the outcomes of the child.

The third ecological level identified by Bronfenbrenner (1994) is the exosystem. This system also contains associations between two or more settings, however, one of the systems does not directly include the child. For instance, incidents that happen within a parent's workplace may not explicitly impact a young child but could influence a child's home life. For example, if a parent loses his or her job, the loss of wages could inhibit the purchase of fresh fruits and vegetables for meals. The loss of job indirectly influences the immediate setting where the child resides.

The fourth and fifth levels in Bronfenbrenner's ecological model (1994) are the macrosystem and chronosystem, respectively. The macrosystem entails characteristics of the broader micro-, meso-, and exosystem cultural beliefs embedded within systems. This system pushes past the simple social or ethnic boundaries to recognize particular occurrences in the macrosystem that directly affect development at the microsystem level. If families sense danger within their community due to harassment or intimidation over their religious beliefs, they may limit their child's outdoor recreation time, illustrating how cultural backgrounds could impact child development and foster negative health habits (i.e., sedentary behavior) into adulthood. The chronosystem accounts for transformation over time, not only in children's lives, but in the environment in which they live. This level entails a variety of changes such as family structure, socioeconomic status, or place of residence. For example, household dynamics drastically change when parents separate, divorce, and remarry other individuals. If these occurrences take place early in a child's life, it not only affects where and with whom he or she lives, but could disrupt healthy lifestyle routines modeled at home and impact health-related issues such as sleeping patterns and dining behaviors.

Lev Vygotsky also believed that environments shape child development, however, he framed his theory around the idea that learning takes place through interactions and social contexts (Schwebel, 1979). His idea that children need support or scaffolding to build knowledge, which he termed the zone of proximal development, required children to be engaged in activities and have the support of a guide to facilitate learning. That is, someone (e.g., teacher, peer, parent) is present to interact and support the child through active discovery, building on skills the child has already mastered while gaining new knowledge. For example, an integrated curriculum might incorporate the reading of a book that involves characters eating unhealthy meals. Those same characters could become finger puppets where children are encouraged to act out the story, then move to the dramatic play area to help build healthy plates. Children just being introduced to healthy foods would need the support of a peer or teacher to correctly create their healthy plate. In this scenario, interactions take place across several curriculum domains (i.e., literacy, creative expression, science) and across different social contexts where the child had someone to help scaffold learning while building upon skills he or she already knew.

Through the ecological theory and zone of proximal development, a student's support system of relatives, friends, and school professionals all assist in meeting a child's needs and can influence personal behaviors, ultimately impacting lifelong, health-related decisions (Bronfenbrenner, 1986; Schwebel, 1979). Since nearly 60% of U.S. children birth to 5 years are enrolled in some type of non-parental child care before kindergarten, including school-based pre-kindergarten (Corcoran & Steinley, 2017), and more specifically, over 43,000 Mississippian children were enrolled in school-based pre-kindergarten and kindergarten programs during the 2017-2018 academic year (Mississippi Department of Education, 2018), it is important to understand the significance of early childhood experiences regrading health education and how those experiences can shape a child's future health-habit routines. Teachers who incorporate lessons promoting healthy lifestyle practices among young children can inspire positive attitudes and behaviors that last a lifetime.

## Background and Significance

### Health Disparities in Mississippi

Obesity is considered one of the issues for enhanced health disparities defined by The Centers for Disease Control and Prevention as "preventable differences in the burden of disease, injury, violence, or opportunities to achieve optimal health that are experienced by socially disadvantaged populations" (2015). Despite efforts through the

U.S. Department of Health and Human Services' 2016 Healthy People 2020 goal to improve health of all by eliminating disparities, over 70% of Mississippi's adult population (Mississippi State Department of Health, 2017) still face disproportionate burdens of illness due to either being identified as overweight or obese in 2015, compared to a national average of 36.5% during 2011-2014 (Centers for Disease Control and Prevention, 2015). Mendy and colleagues (2017) examined Mississippi obesity prevalence patterns by comparing information gathered from 2001 through 2011 and again from 2011 through 2015 using the Mississippi Behavioral Risk Factor Surveillance System. Data including overweight, obesity, and extreme obesity among adults were analyzed for annual percentage changes (APC) not only in general populations, but also across race and gender. Although a decrease in overweight prevalence was observed from 2001 to 2010 overall (APC, -1.3%) and among African American (AA) and European American (EA) men (APC, -1.0%), no decrease occurred among women. However, rising drastically were both obesity (APC 2.9%) and extreme obesity (APC 3.6%) across all subgroups: men, women, AA and EAs. From 2011 to 2015, only one considerable increase of prevalence is noted and that is extreme obesity among EAs (APC, 2.6%). Mendy and Vargas (2015) examined weight trends from years 2001 to 2010 within the Mississippi Delta Region, where populations are predominately AA, and many communities are described as low socioeconomic status (SES) with poor health conditions (United States Census Bureau, 2014), and they found a considerable 3.5% rise in obesity prevalence during those years.

The National Survey of Children's Health reported a national average of overweight children at 15.6% compared to 18.0% for Mississippi children and 15.7%

were obese nationally, compared to 21.7% for Mississippi children (2012). Even though eating a balanced diet of fruits and vegetables is proven to provide important nutrients associated with lowering risks of chronic diseases (Liu, 2013) and could help in the aid of controlling weight, much of the United States population, including children, do not consume the recommended daily amounts suggested by the U.S. Department of Agriculture (USDA) (Moore et al., 2015). According to the 2005-2008 National Health and Nutrition Examination Survey (NHANES), children who reside in economically disadvantaged households are affected disproportionately by limited fruit and vegetable choices, low-quality diets, and elevated obesity rates compared to children of higher income families, and the gap continues to grow (Braveman et al., 2010; Ogden et al., 2010). Oftentimes, diet inequality is a result of accessibility, higher prices within impoverished communities, or families' lack of knowledge in regard to nutritional benefits of fruit and vegetable consumption (Larson et al., 2009; Liu, 2013).

Although obesity can be defined simplistically - ingesting more calories than one burns through exercise - the cause of obesity is more complex. It is true that some individuals are biologically predisposed to weight struggles (Ali & Crowther, 2009), however several other contributing factors have been identified. Sedentary lifestyles, coupled with diets high in sugar, sodium, and saturated fats have significant negative health consequences no matter the household economic status, but can be particularly hard on children from low-income families (Dixon et al., 2012) where access to fresh fruits or vegetables and lack of quality health care is limited. Social conduct within cultural environments, learned familial food choices, sleep patterns, activity levels, and junk-food advertisements aimed at children have also been discovered to impact a child's overall weight (Cappuccio et al., 2008; Grant et al., 2016; Papoutsi et al., 2013).

Children considered obese can experience both immediate and lasting negative health implications and the effects are seen across developmental domains including emotional, social, and physical health (Federal Interagency Forum on Child and Family Statistics, 2017; Institute of Medicine, 2012). Obese children are frequently ostracized by other children, feel secluded and suffer emotional distress or anxiety, impacting psychological well-being (Griffis et al., 2010; Pont et al., 2017). Oftentimes these immediate effects have long-term consequences, transforming into conditions such as low self-esteem or chronic depression (Griffiths et al., 2010). Physical health is affected through the development of lasting circumstances or illnesses known to manifest alongside obesity, such as asthma, sleep apnea, and type 2 diabetes (Hoelscher et al., 2013; Institute of Medicine, 2012).

**Physical Exercise and Obesity**

Physical activity (PA) impacts overall, long-term health in a multitude of ways, including advantages such as maintaining body fitness and reducing the risk of chronic disease (World Health Organization [WHO], 2010). Children who participate in the well-agreed upon recommendation of 60 minutes per day of moderate-to-vigorous physical activity (MVPA) are not only more physically fit, but are engaging in valuable actions that help control body weight and ultimately combat risks of becoming overweight or obese (Gaba et al., 2016; Raistenskis et al., 2016; Schwarfischer et al., 2017). Schwarfischer and colleagues (2017) found the amount of daily PA in which children engage differs by gender (i.e., females are less active than males) and also by weight (i.e., overweight and obese children are more inactive than children falling within normal weight ranges). In particular, MVPA rates for overweight and obese children averaged 22.4 minutes less per day and 50.9 meters less on average during a 6-minute timed test than normal-weight children (Raistenskis et al., 2016).

The more time children spend on sedentary behavior, the more likely they are to be overweight and have a high BMI reading, increasing the risk of childhood cardiovascular disease (Mitchell et al., 2013; Schwarfischer et al., 2017). Though active children tend to be more physically fit than their obese and overweight counterparts, not all children with a high BMI fail to meet the recommended daily PA of 60 minutes per day (Labree et al., 2015).  However, obese children involved in daily exercise may experience fewer risk factors than those obese children who are not active, especially if they are active an additional 15-20 minutes per day above the recommended MVPA amount (Raistenskis et al., 2016; Schwarfischer et al., 2017).

According to the Center for Public Education (2006), the majority of U.S. students spend 6 hours per day in school for an average 180 days of the year. A good bit of that day consists of sitting in desks or at table and chairs being inactive. Furthermore, some schools across the nation have shortened or completely done away with recess in hopes of engaging students in more important learning tasks within the classroom (Zygmunt-Fillwalk & Bilello, 2005).  Additionally, approximately 90% of parents completing a survey for the Young Men's Christian Association (YMCA, 2011) acknowledged providing a healthy home environment, however 41% of their children participated in 60 minutes of PA less than once a week. Based on provided information supporting the claim that PA promotes healthy child outcomes and improves long-term health, and that children are spending less time being active at school, kindergarten and pre-kindergarten programs are in need of cross curriculum programs that encourage and support structured PA throughout the day.

**Nutrition and Obesity**

Despite research supporting the benefits of eating healthy, data show a decline in families, especially those of lower income, purchasing and eating an assortment of fruits and vegetables (Nguyen et al., 2016; Phipps et al., 2015). In fact, the Economic Research Service (ERS) found that poorer households are more inclined to eat below the suggested amounts of not only fruit and vegetables, but also whole grains and low-fat dairy products (2008). Eating patterns of inadequate nutrition, such as high sugar, sodium, and saturated fat intake or small amounts of fruit and vegetable consumption, can adversely influence BMI and contribute to increased obesity levels (Anggraeni, 2017; de Jong, 2014; Grosso et al., 2017). Also worth noting is the harmful impact of childhood eating practices on adult health and the difficulty in breaking unhealthy eating habits when they are passed down through generations (Nicklaus & Remy, 2013; Savage et al., 2007), highlighting the importance of targeting children when they are young and taking a comprehensive approach to education (e.g., school to home connection).

The U.S. Department of Agriculture (USDA) along with the office of Health and Human Services (HHS) jointly publish a report every five years that outlines nutritional and dietary guidelines for the general public ranging from the age of two and older. The dietary guidelines, historically recognized through the popular MyPyramid, focused on individual food groups and nutrients. However, since food is not consumed in isolation but simultaneously with other foods, the USDA and HHS redesigned the MyPyramid in summer of 2011 to complement the 2010 newly revised nutritional guidelines. The new format, in an effort to encourage healthier food and drink selections among Americans and ultimately influence an individual's eating patterns positively, represents the five food groups through a recognizable visual: a place setting (USDA; Center for Nutrition Policy and Promotion, 2017). The memorable mealtime image "grabs the consumer's attention" by connecting them to healthy eating while displaying appropriate portion sizes from all food categories - fruits, vegetables, grains, protein, and dairy (USDA-ChooseMyPlate, 2018). With hopes of reminding diners of the daily food recommendations, one-half of the plate depicts fruits and vegetables while the other half shows grains and protein.  Dairy is represented with a small circle to the top right of the plate, signifying a drink to accommodate a meal, such as a glass of whole milk (see Appendix B). Fats, sodium, and sugar are not denoted on the visual in order to remind individuals that these items are not part of a healthy meal and should be eaten in moderation (USDA-ChooseMyPlate, 2018).

While government funded programs like USDA's MyPlate help to market nutritional guidelines, they tend to fall short in homes where there are higher poverty rates (Mendy & Vargas, 2015). According to the CDC, families living in poverty that receive WIC or Supplemental Nutrition Assistance Program (SNAP) benefits are beginning to make slight progress on eating healthier food, such as less fast food and more fresh fruit and vegetables (Molitor et al., 2015). WIC is a federal program that promotes healthy eating and nutritious education for infants and children up to age five years, and low-income women who are pregnant, postpartum, or breastfeeding (USDA, 2018). This program allows families to specifically buy more nutritious foods from approved lists. However, families with older children do not qualify. These poorer, disadvantaged neighborhoods tend to lack access to affordable nutritious foods, particularly fresh fruits and vegetables (Ogden et al., 2010). Many young children in Mississippi, according to the latest US Census (2016), live in poverty revealing that Mississippi has the lowest household income of all 50 states at $41,754. Early childhood programs that address obesity and nutrition in cross curriculum environments are sorely needed to help improve the health and wellness of the next generation.

**Sleep and Obesity**

Although heredity, nutrition, and physical activity influence individual weight, they are not the only factors that can increase obesity among children. Evidence continues to build supporting a connection between sleep and obesity. Adverse sleep behaviors, including poor sleep quality such as irregular sleep patterns and frequent interruptions in sleep, are examples of fundamental activities associated with heavier body composition and are considered strong risk factors for obesity (Labree et al., 2015). Both the Commission of Ending Childhood Obesity (ECHO; WHO, 2017) and Cappuccio and associates (2008) reiterate the negative influence sleep patterns can have on health outcomes, in particularly how being overweight or obese is associated with short sleep duration. In fact, Celis-Morales and colleagues (2017) concluded that sleep duration heightens the risk for obesity when it is associated with genetic predisposition for obesity and high BMI scores. Their analysis of individual genetic sampling from 119,859 white European adults (ages range from 37-73), coupled with self-completed surveys, revealed differences for individuals with a greater profile risk score for obesity (GPRS-obesity) according to characteristics of sleep periods. In comparing similar sleepers with high GPRS-obesity levels, they concluded that short duration sleepers (<7 hrs/day) were linked to a 0.6 higher BMI, and long duration sleepers (>9 hrs/day) were linked to 1.1 higher BMI than those with normal sleep duration (7-9 hrs/day).

In addition, there is also a risk of greater BMI readings when those children categorized as short sleepers engage in low levels of activity during free time. In other words, they would normally be sleeping, but instead are awake and not active (Busto-Zapico et al., 2014). This research suggests that high BMI may not be a direct affect of loss of sleep, but instead an important result of low physical activity level coupled with smaller amounts of sleep, ultimately leading to weight gain.

Sleep deprivation is also associated with the interference of hormone levels that regulate feelings of hunger known as ghrelin and that regulate appetite satisfaction known as leptin (Spiegel et al., 2004; Taheri et al., 2004). When an individual experiences fewer hours per night of sleep, their leptin production is reduced and ghrelin production is increased, which leads to greater hunger and overeating (Spiegel et al., 2004). In fact, Taheri and associates (2004) found when adult sleepers regularly sleep 5 hours per night instead of 8 hours consistently, they register lesser amounts of leptin at 15.5% and greater ghrelin levels at 14.9%. Labree et al. (2015) validates concerns that sleep length is a variable risk factor leading to overweight and obesity and is supported by Cawley (2006) on the idea that parental control of bedtimes and setting boundaries on leisure activities associated with sedentary behavior could positively impact the reduction of childhood obesity. However, pediatricians cite that parents commonly complain about children's bedtime resistance (Mindell & Owens, 2003), and research shows that parents often are not aware of sleep recommendations for children (Buxton et al., 2015). The National

Sleep Foundation (Hirshkowitz et al., 2015) alongside the American Association of Pediatrics and the American Academy of Sleep Medicine (Paruthi et al., 2016) recommends children ages 3 to 5 obtain 10-13 hours of sleep over the course of a 24-hour period (nighttime + napping), yet research shows that most do not get the recommended amount (Buxton et al., 2015; Scharf & DeBoer, 2015). Historically, early childhood programs have not included sleep education curriculum, but considering recent evidence on the important role sleep has on our health and understanding that health habits are formed at an early age (Nicklaus & Remy, 2013; Savage et al., 2007), it is clear that discussions regarding healthy sleep regiment should be included. Programs designed to include sleep instruction could also help parents to understand how important getting the appropriate amount of sleep is for their young child while also establishing positive sleep habits at an early age. It could also help to establish an environment conducive to positive nightly routines and promote bedtime cooperation from the child.

**Education Factors**

Health education, a content strand falling under the curriculum of science, has existed in various forms of U.S. education since colonial times (Allensworth et al., 1997). In the beginning, services provided to school children could range from performing minor surgery to conducting routine health exams. The focus in those early years was to address imminent health issues students were facing, however, the period after World War I marked a new era where most schools began to include programs to also advance lifestyle practices (Means, 1975). The development of curriculum with a concentration on teaching behaviors that would improve overall healthy practices shifted health attention to classroom teachers instead of medical professionals and prompted instruction to begin discussing health topics, such as nutrition, in the classroom (Allensworth et al., 1997). According to Funk and Wagnalls New World Encyclopedia (2017), physical education also has deep roots in the American education system, which included gymnastics for strength and agility training early in the 19th century. Although intentional focus on nutrition was implemented in schools in 1918, it was not until the mid-1990s that health organizations (i.e., Centers for Disease and Prevention) began to advocate for a more comprehensive physical education program that included recommendations of daily activity in public schools (The Office of Disease Prevention and Health Promotion, 2018). Sleep education, on the other hand, is lacking in representation among health education programs. Despite sleep being identified as an important component of healthy living as far back as the 1800's (Schulz & Salzarulo, 2016), it has never been the focus of an educational promotion. In fact, the only significant sleep-based endorsement supported by the U.S. government is the "Safe to Sleep" campaign, initiated in 1994 and originally called "Back to Sleep," which focused on creating safe sleep environments for infants (Eunice Kennedy Shriver National Institute of Child Health and Human Development, 2018).

Although health education throughout the years has evolved, schools remain an important location to encourage healthy behaviors among American students. In fact, *Healthy People 2020* (US Department of Health and Human Services, 2010) identifies schools as an ideal environment to create and support policies regarding "Nutrition and Weight Status." Given that habits form at an early age and that children who struggle with weight tend to carry those struggles into adulthood (Nicklaus & Remy, 2013; Puhl

& Luedicke, 2012), early childhood programs should embrace opportunities to engage young children in learning opportunities to discuss what bodies need to live healthy.

Mississippi's children face disparities related not only to health and wellbeing, but also with educational success. Challenges in regard to academic accomplishment, specifically in the field of science, are apparent according to the United States Department of Education's (USDE) 2015 Nation Report Card. Mississippi students' average score on a national assessment in science was lower than the national average score of 43 states/jurisdictions in the country, with zero percent of those students scoring advanced. Differences are also present among students' science achievement level within the state of Mississippi. Nothing of significance emerged among gender, however, both AA and Hispanic students had an overall score lower than EA students (34 points and 17 points lower respectively; USDE, 2015). Low family income, as indicated by 71.5% of Mississippi students qualifying for free or price-reduced lunches (compared to 49.6% nationally; National Center for Education Statistics, 2013), was also a factor. Children qualifying for price reductions scored an average 29 points lower on science assessments than students who were not eligible for a reduction in lunch prices (USDE, 2015).

Although research shows exposure to effective inquiry-based, child-centered science exploration and instruction during younger years provides students the opportunity to gain valuable skills such as critical thinking, theoretical understanding, and enhances science conceptual knowledge later in life (Eshach and Fried, 2005; Haury, 2001; Songer et al., 2002; Zhai & Tan, 2015), experience tells us that students are not encountering many of these approaches in the classroom. In fact, Tu (2006) found that early childhood teachers hardly ever involve children in structured science lessons. While an educator’s understanding of science content and confidence in teaching those concepts are both robust predictors of student’s science learning, researchers are repeatedly finding that teachers, including preservice candidates, feel inadequate when it comes to teaching science (Lee & Shea, 2016; Pendergast et al., 2017; Zhai & Tan, 2015). According to the Committee on Integrated STEM (Science, Technology, Engineering, and Mathematics) Education (2014), teachers with higher levels of science know-how tend to have higher levels of self-efficacy as it relates to teaching science, especially in areas such as engineering (Hammack & Ivey, 2017). They also are inclined to incorporate more of the preferred student-centered, inquiry based teaching methods into their lessons, utilize research to guide instruction, and exhibit optimistic outlooks on becoming part of the teaching profession as opposed to the less effective teacher-lecture methods utilized by educators with lower self-efficacy perspectives (Plourde, 2002; Uyanik, 2016; Yildiz-Duban & Gokcakan, 2012).

Though it is true that science scores tend to be lower with children reared in socioeconomically challenged environments and that teachers with low science confidence may not implement effective science lessons, research suggests additional factors that may exacerbate the lower scores. As detailed in the Report of the 2012 National Survey of Science and Mathematics Education (Horizon Research, 2013), time spent on task for science during a pre-kindergarten through third grade level school day was remarkably low (i.e., 19 minutes) compared to other curriculum domains such as language arts (i.e., 89 minutes) and math (i.e., 54 minutes). Teachers have indicated a lack of time during the school day, partly due to science being considered an “extra” that competes with other courses considered more important to a student’s educational program, such as learning to read (Perera et al., 2015), suggesting that teachers are under pressure to focus on lessons in tested subjects instead of science related topics. This area is where teachers could utilize the effective practice of integrating science or STEM into lessons that span across all curriculum domains: reading, writing, math, spelling, and social studies (Dudley et al., 2015; Tippet & Milford, 2017; Wright & Gotwals, 2017). Simply put, science instructional practices do not always need to be taught as stand-alone lessons, but could be infused into not only curriculum domains, but activities (e.g., centers, recess) that span across a student's school day (Gerde, 2013). For example, when teachers are focusing on fluency related skills, they could use science-based stories or employ food models (e.g., plastic fruits and vegetables) while teaching mathematical skills and discussing nutritional benefits to our bodies.

STEM classroom instruction involves intermingling real-world encounters while applying science, technology, engineering, and mathematics. Though it has a tendency to support the growth of scientific content knowledge for all students, it has been linked specifically to inspiring students, including women and minorities, to pursue occupations and advanced degrees connected to STEM disciplines (National Research Council (NRC), 2011). To infuse science-based learning opportunities, such as STEM instruction, into American classrooms is quickly becoming an educational priority across the United States. In September 2017, a Presidential Memorandum was signed by Donald J. Trump offering K-12 students additional access to STEM and Computer Science instruction. Trump's overall objective is to offer critical tools and learning experiences "to provide Americans, particularly young Americans, the skills they need to be competitive in the job market," which will ultimately lead to high quality, steady employment (The White

House, 2017). On the other hand, if Mississippi students do not have access to inquiry-based, STEM focused instruction during the early years, they may struggle in developing essential tools necessary to acquire careers in the field of science, technology, engineering, and mathematics.

To increase STEM and health courses available to early childhood teachers in Mississippi, *The WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science curriculum was designed through funding from the National Institutes of Health (NIH) Science Education Partnership Award (SEPA). Since research shows that science lessons are limited, and oftentimes nonexistent throughout the school day within an early childhood setting (Horizon Research, 2013; Perera et al.,2015), a team at Mississippi State University representing several departments across campus, collaborating with the North Mississippi Health Science Museum HealthWorks! and Social Science Research Center, created a two-week, integrated-curriculum and fieldtrip program that intentionally targeted the development of healthy habits while building on skills across curriculum domains (i.e., creative expressions, language/literacy, math, science). Teachers attended a one-hour professional development training prior to implementing the program in classrooms, and students, after completing the health science curriculum plan, participated in a 90-minute, community-based field trip to HealthWorks! North Mississippi where activities supportive of the healthy curriculum lessons were emphasized. While this 2-week, 50-lesson health science unit focused on integrating specific themes of nutrition, physical activity, and sleep hygiene across all curriculum domains (i.e., books, creative expressions, language/literacy, math, science), the ultimate goal was to lessen the occurrence of obesity within Mississippi.

## Curriculum Description

The *WannaBee Healthy? Be Smart, Be Active! Be a Leader!* health science curriculum was created to diminish the prevalence of obesity by encouraging the development of healthy habits in young children through an integration design of curriculum domains (i.e., books, creative expression, language/literacy, math, science). The two-week curriculum, designed to meet the needs of both typically developing children and those who have special needs, offered teachers a number of integrated activities presented using three bee characters: Bee Active (Andy), Bee Smart (Sunny), and Bee a Leader (LaToya). Through the 'life of bees,' pre-kindergarten and kindergarten learners were encouraged to engage in developmentally appropriate experiences intended to advance health science education across core curriculum domains: books, creative expressions, language/literacy, math, and science. Innovative, play-based activities led students to explore positive health habits, articulate alternatives to poor diet and beverage choices, and think critically to improve overall health while exposing them to hands-on lessons. The focus had a two pronged approach, taking aim at increasing children's health and agricultural literacy while also strengthening their school and home environments through teacher professional development and parent involvement.

The curriculum incorporates 50 creative lessons for the classroom to increase students' knowledge about nutrition, physical activity, and advocating for positive health behaviors such as good sleep hygiene, within their communities. Special care was taken to align teaching with the Mississippi Early Learning Standards (MSELS), Next Generation Science Standards (NGSS) for kindergarten, and the Centers for Disease Control and Prevention (CDC) National Health Education Standards. The overarching objective of the grant was to increase child knowledge of the benefit to eating healthy foods and understanding the impact of the USDA MyPlate, identifying the impact on health through being active, and accepting the role as advocates in their school, homes, and even in their communities; all components aimed at reducing obesity. Through teacher guided activities, students were allowed to participate in innovative ways to build life-long healthy habits through exploration, critical investigation, and problem solving.

In order to encourage effective teacher implementation and ensure that activities were infused in all curriculum domains throughout the school day, creators of The *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science program provided in-depth lesson plans covering areas of language and literacy, creative expression, math, and science. Each day began with the reading of a book, and teachers were given suggestions on ways to extend the theme of the book by engaging children in discussions about building positive health-related habits. The rest of the day's lessons were planned by infusing the health theme into all aspects of the school day, incorporating follow-up activities with a variety of engaging activities such as matching games, creating charts or graphs, role-playing, retelling with flannel board characters, planting seeds, and movement through music. All follow-up activities facilitated further discussion on positive health habits while targeting specific skills within each curriculum domain: books, creative expression, language/literacy, math, and science. For example, after reading *Healthy Eating with My Plate: Grains*, students discussed how food, in particularly grains, provides energy for the body, then were lead in singing and moving to the song "Head, Shoulders, Knees and Toes." Afterwards, they tasted a variety of fruits and vegetables, and created a classroom graph of each child's favorite, discussing which had the most and least amount of votes. Through this one setting, teachers were able to not only reinforce reading comprehension skills, but to include math and physical activity as well.

Nutrition was the curriculum's main focus as 43 of the available 50 lessons addressed the importance of healthy foods and beverages through discussion topics such as characteristics of fruits and vegetables, the USDA MyPlate, and food origins. The curriculum was designed to engage students in hands-on activities, such as using plastic food in the dramatic play area to create healthy meals or predicting the amount of sugar in various drinks, then discussing and displaying the actual amounts on a bar graph. Physical fitness was spotlighted in 12 of the available 50 lessons and often encouraged student exercise or movement through music and role play. Popular nursery rhymes, poems, and songs were often adapted to fit the 'life of bees' format by using the three bee characters (Andy, Sunny, and LaToya) in the verses or phrasing. The importance of getting enough sleep or rest was included in 3 of the available 50 lessons through discussions on the importance of getting the recommended 10 hours each day. Children also were asked to model ways they settle themselves down for sleep by using dolls and an area designated for napping. They were urged to share bedtime routines from home and brainstorm ways to create a "cozy" environment conducive to safe, restful sleep.

Teachers were provided a one-hour training not only on implementing the health science curriculum, but also how to use the resource toolkit of supplemental materials and ideas. Taking into consideration that districts have different procedures, pacing guides, and timeframes that could hinder teacher execution and completion of the whole program, the option was given to either complete the lessons within the original two-week format or spread the lessons across a four-week period. The curriculum was implemented in a different set of schools each semester for three consecutive semesters. After completing the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science curriculum, students participated in a 90 minute, community-based field trip to HealthWorks! North Mississippi where activities supportive of the healthy curriculum lessons were emphasized. Pre-implementation assessments were conducted individually with a random sample of children from the participating classrooms. These same children were assessed again following their engagement in the program.

## Research Objectives

The current dissertation will include two secondary quantitative data analyses studies. Both studies stem from a larger grant funded through the National Institutes of Health, Science Education Partnership Award (SEPA) focused on reducing obesity rates in Mississippi. Only components of the larger study pertinent to these studies are detailed.

Study 1 (manuscript 1) is a descriptive study in which the number of activities within each curriculum domain (i.e., books, creative expression, language/literacy, math, science) and the number of activities within each lesson theme (i.e., nutrition, physical activity, sleep) chosen for implementation by teachers participating in the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science curriculum was assessed. This study aimed to expand understanding about teacher implementation of curriculum domains (i.e., books, creative expression, language/literacy, math, and science) and themes (i.e., nutrition, physical activity, and sleep) within the context of an integrated health science curriculum for early childhood classrooms.

Using the results of Study 1 to further understand how overall teacher implementation of the curriculum related to changes in child health knowledge, Study 2 (manuscript 2) is an examination of associations between the dosage of the *WannaBee Healthy?* curriculum implemented within each classroom (i.e., frequency use of curriculum domains; frequency of use of lesson themes) and child outcomes (e.g., USDA MyPlate accuracy). Namely, is the dosage and content of curriculum implementation related to children's ability to successfully identify the following: (1) food from each of the five food groups, (2) a healthy plate that includes all recommended food groups, (3) food origins, (4) four activities that increase heart rate, and (5) the combination of sleep, healthy plate and physical activity as behaviors needed to keep our body healthy. The aim of the second study is to evaluate whether the teachers' choice in dosage and type of activity implementation of the *WannaBee Healthy?* curriculum is associated with children's specific types of gain in knowledge of healthy behaviors.

Based on available evidence, I expect that teachers will use fewer science-based lessons than the other curriculum domains due to lower self-confidence in science abilities of early childhood teachers (Pendergast et al., 2017). Conversely, I expect that lessons from the curriculum that are focused on literacy will be used most by teachers given the academic focus on literacy in the early public schooling years (Horizon Research, 2013). Additionally, it is well-established in the literature that greater exposure to content and higher rates of integrated lessons lead to greater knowledge change (Perera et al., 2015; Tippett & Milford, 2017). Thus, I expect children who perform the best on the child assessments will be from classrooms in which the teacher chose to implement larger numbers of activities from the curriculum.

## References

Ali, A., & Crowther, N. (2009). Factors predisposing to obesity: a review of the literature. *Journal of Endocrinology, Metabolism and Diabetes of South Africa, 14*, 81–84.

Alkon, A., Crowley, A., Neelon, S., Hill, S., Pan, Y., Nguyen, V., & Kotch, J. (2014). Nutrition and physical activity randomized control trial in child care centers improve knowledge, policies, and children's body mass index. *BMC Public Health*, *14*(1), 215. doi:10.1186/1471-2458-14-215

Allensworth, D., Lawson, E., Nicholson, L., et al. (1997). Institute of Medicine (US) Committee on Comprehensive School Health Programs in Grades K-12. Schools & Health: Our Nation's Investment. Washington, DC: National Academies Press, US. Retrieved August, 2018 from www.ncbi.nlm.nih.gov/books/NBK232693/

Anggraeni, A. S., Tintin, S., & Kristiawati, K. (2017). Consumption of fruit and vegetable with risk of obesity in school-age children. *Jurnal Ners. 12*(1), 27-32.

Aud, S., Hussar, W., Johnson, F., Kena, G., Roth, E., Manning, E., & Zhang, J. (2012). The condition of education 2012 (NCES 2012-045). Retrieved June, 2017 from U.S. Department of Education, National Center for Education Statistics: https://nces.ed.gov/pubs2012/2012045.pdf

Blunden, S., & Rigney, G. (2015). Lessons learned from sleep education in schools: A review of dos and don'ts. *Journal of Clinical Sleep Medicine*, *11*, 671-680.

Braveman, P., Cubbin, C., Egerter, S., Williams, D., & Pamuk, E. (2010). Socioeconomic disparities in health in the United States: What the patterns tell us. *American Journal Public Health, 100*(Supp 1), S186-196.

Bronfenbrenner, U. (1974). Developmental Research, Public Policy, and the Ecology of Childhood. Child Development, *45*(1), 1-5.

Bronfenbrenner, U. (1986). Ecology of the family as a context for human development. Research perspectives. *Developmental Psychology*, *22*(6), 723-742.

Bronfenbrenner, U. (1994). Ecological models of human development. *International Encyclopedia of Education*, Volume 3, 2nd edition. Oxford: Elsevier.

Busto-Zapico, R., Amigo-Vazquez, I., Pena-Suarez, E., & Fernandez-Rodriguez, C. (2014). Relationships between sleeping habits, sedentary leisure activities and childhood overweight and obesity. *Psychology, Health and Medicine*, *19*(6), 667-672.

Buxton, O., Chang, A., Spilsbury, J., Bos, T., Emsellem, H., & Knutson, K. (2015). Sleep in the modern family: Protective family routines for child and adolescent. *Sleep Health: Journal of the National Sleep Foundation*, *1*, 15-27.

Cappuccio, F., Taggart, F., Kandala, N., Currie, A., Stranges, S., & Miller, M. (2008). Meta-analysis of short sleep duration and obesity in children and adults. *Sleep*, *31*(5), 619-626.

Cawley, J. (2006). Markets and childhood obesity policy. *Future Child*, *16*(1), 69-88.

Celis-Morales, C., Lyall, D., Guo, Y., Steell, L., Llanas, D., Ward, J.,…Gill, M. (2017). Sleep characteristics modify the association of genetic predisposition with obesity and anthropometric measurements in 119,679 UK biobank participants. *The American Journal of Clinical Nutrition*, *105*, 980-990.

Center for Public Education. (2006). Making time: What research says about reorganizing school Schedules. Alexandria, VA. Retrieved July, 2018 from http://centerforpublicaiton.org

Centers for Disease Control and Prevention. (2012). Mississippi – state nutrition, physical activity, and obesity profile. Retrieved October, 2017 from http://www.cdc.gov

Centers for Disease Control and Prevention. (2015). About child & teen BMI. Retrieved October, 2017 from https://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html

Centers for Disease Control and Prevention. (2016). Childhood obesity facts. Retrieved October, 2017 from http://www.cdc.gov/healthyschools/obesity/facts.htm

Committee on Integrated STEM Education. (2014). STEM integration in K-12 education; status, prospects, and an agenda for research. Washington, DC: The National Academies Press.

Corcoran, L., & Steinley, K. (2017). Early childhood program participation, from the National Household Education Surveys Program of 2016 (NCES 2017-101), National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC. Retrieved March, 2017 from http://nces.ed.gov/pubsearch

Data Resource Center for Child & Adolescent Health. The National Survey of Children’s Health. Retrieved October, 2017 from http://www.childhealth.data.org de Jong, E., HiraSing, R., Renders, C., Seidell, J., & Visscher, T. (2014). Home environmental determinants of children's fruit and vegetable consumption across different SES backgrounds. *Pediatric Obesity*, *10*, 134-140.

Dixon, B., Pena, M., & Taveras, E. (2012). Lifecourse approach to racial/ethnic disparities in childhood obesity. *Advances in Nutrition*, *3*(1), 73-82. doi:10.3945/an.111,000919

Dudley, D., Cotton, W., & Peralta, L. (2015). Teaching approaches and strategies that promote healthy eating in primary school children: A systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, *12*, 28.

Eshach, H., & Fried, M. (2005). Should science be taught in early childhood? *Journal of Science Education and Technolog*y, *14*, 315-336.

Eunice Kennedy Shriver National Institute of Child Health and Human Development. (2018). Safe to Sleep Public Education Campaign. Retrieved August, 2018 from https://www1.nichd.nih.gov/sts/campaign/moments/Pages/default.aspx

Federal Interagency Forum on Child and Family Statistics. (2017). America's children: Key national indicators of well-being. Washington, DC: U.S. Government Printing Office.

Finkelstein, E., Trogdon, J., Cohen, J., & Dietz, W. (2009). Annual medical spending attributable to obesity: Payer- and service-specific estimates. Health Affairs, *25*(5), w822-w831.

Frisvold, D., & Lumeng, J. (2011). Expanding exposure: Can increasing the daily duration of Head Start reduce childhood obesity? *Journal of Human Resources*, *46*(2), 373-402.

Gaga, A., Dygryn, J., Mitas, J., Jakubec, L., & Fromel, K. (2016). Effect of accelerometer cut-off points on the recommended level of physical activity for obesity prevention in children. *PLoS ONE*, *11*(10): e0164282. doi:10.1371/journal.pone.0164282

Gerde, H., Schachter, B., & Wasik, B. (2013). Using the scientific method to guide learning: An integrated approach to early childhood curriculum. *Early Childhood Education Journal 41*, 315-323.

Grant, T., Lott, L., Courtney, C., Johnson, X., Sutton, V., & Zhang, L. (2016). Mississippi Obesity Action Plan, the Office of Preventive Health and the Office of Health Date & Research. Mississippi State Department of Health, Jackson, MS.

Griffiths, L., Parsons, T., & Hill, A. (2010). Self-esteem and quality of life in obese children and adolescents: A systematic review. *International Journal of Pediatric Obesity*, *5*(4), 282-304.

Grosso, G., Micek, A., Godos, J., Pajak, A., Sciacca, S., Galvano, F., & Boffetta, P. (2017). Health risk factors associated with meat, fruit and vegetable consumption in cohort studies: A comprehensive meta-analysis.  PLoS Medicine, *12*(8), 1-21.

Hammack, R., & Ivey, T. (2017). Examining elementary teachers' engineering self-efficacy and engineering teacher efficacy. *School Science and Mathematics*, *117*, 1-2.

Haury, D.I. (2001). Teaching science through inquiry with archived data.  Columbus, OH: ERIC Clearinghouse for Science Mathematics and Environmental Education. (ED465545)

Hirshkowitz, M., Whiton, K., Albert, S., Alessi, C., Bruni, O., DonCarlos, L., … Hillard, P.  (2015).  National Sleep Foundation's sleep time duration recommendations: Methodology and results summary. *Sleep Health: Journal of the National Sleep Foundation*, *1*, 40-43.

Hoelscher, D. M., Kirk, S., Ritchie, L., & Cunningham-Sabo, L. (2013). From the Academy: Position of the Academy of Nutrition and Dietetics: Interventions for the prevention and treatment of pediatric overweight and obesity. *Journal of The Academy of Nutrition and Dietetics.* Institute of Education Sciences. National Center for Education Statistics. Retrieved October, 2017 from http://www.nces.ed.gov/programs/digest/d13/tables/dt13_204.10.asp

Horizon Research. (2013). Report of the 2012 national survey of science and mathematics education. Chapel Hill, NC: NSSME.

Institute of Medicine. (2012).  Accelerating progress in obesity prevention: Solving the weight of the nation.  Washington, D.C.; National Academies Press.

Kitahara, C., Flint, A., Berrington de Gonzalez, A., et al. (2014). Association between class III obesity (BMI of 40-59 kg/m) and mortality: A pooled analysis of 20 prospective studies. *PLoS Medicine*, doi:10.1371/journal.pmed.1001673

Labree, W., van de Mheen, D., Rutten, F., Rodenburg, G., Koopmans, G., & Foets, M. (2015). Differences in overweight and obesity among children from migrant and native origin: The role of physical activity, dietary intake, and sleep duration. *PLoS ONE*, *10*(6): e0123672. doi:10.1371/journal.pone.0123672

Lanigan, J. (2011). The substance and sources of young children's healthy eating and physical activity knowledge: Implications for obesity prevention efforts. *Child: Care, Health, and Development*, *37*(3), 368-376. doi:10.1111/j.1365-2214.2010.01191.x

Larson, N., Story, M., & Nelson, M. (2009). Neighborhood environments: Disparities in access to healthy foods in the U.S. *American Journal of Preventive Medicine, 36*, 74-81.

Lee, C., & Shea, M. (2016). An analysis of pre-service elementary teachers' understanding of inquiry-based teaching. *Science Education International*, *27*(2), 217-237.

Liu, R.H. (2013). Health-promoting components of fruits and vegetables in the diet. *Advanced Nutrition*, *4*, 384-392.

Means, R. (1975). *Historical Perspectives on School Health*. Thorofare, N.J.: Charles B. Slack.

Mendy, V., Vargas, R., Cannon-Smith, G., & Payton, M. (2017). Overweight, obesity, and extreme obesity among Mississippi adults, 2001–2010 and 2011–2015. *Preventing Chronic Disease,* (*14*):160554. doi: http://dx.doi.org/10.5888/pcd14.160554

Mendy, V., & Vargas, R. (2015). Trends in major risk factors for cardiovascular disease among adults in the Mississippi Delta region, Mississippi Behavioral Risk Factor Surveillance System, 2001-2010. *Preventing Chronic Disease, 12*, E21.

Mindell, J., & Owens, J. (2003). Sleep problems in pediatric practice: Clinical issues for the pediatric nurse practitioner. *Journal of Pediatric Health Care*, *17*(6), 324-331.

Mississippi Department of Education. (2006). Mississippi physical education framework. Retrieved November, 2017 from htpp://sos.ms.gov/ACProposed/00019500b.pdf

Mississippi Department of Education. (2018). Mississippi enrollment report: Year 2018. Retrieved July, 2018 from http://mdereports.mdek12.org/data/

Mississippi State Department of Health. Mississippi Behavioral Risk Factor Surveillance System. Retrieved September, 2017 from http://msdh.ms.gov/brfss/

Mississippi State Department of Health. The Child and Youth Prevalence of Obesity Surveys, 2013. Retrieved September, 2017 from http://msdh.ms.gov

Mitchell, J., Pate, R., Beets, M., & Nader, P. (2013). Time spent in sedentary behavior and changes in childhood BMI: A longitudinal study from ages 9 to 15 years. *International Journal of Obesity*, *37*, 54-60.

Molitor, F., Sugerman, S., Yu, H., Biehl, M., Aydin, M., Levy, M., et al. (2015). Reach of Supplemental Nutrition Assistance Program-Education (SNAP-E) interventions and nutrition and physical activity-related outcomes. California. doi:http://dx.doi.org/10.5888/pcd12.140449

Moore, L., Dodd, K., Thompson, F., Grimm, K., Kim, S., & Scanion, K. (2015). Using Behavioral Risk Factor Surveillance System data to estimate the percentage of the population meeting US Department of Agriculture food patterns: Fruit and vegetable intake recommendations. *American Journal of Epidemiology*, *181*, 979-988.

National Association for Sport and Physical Education. (2010). Shape of the Nation Report. Retrieved October, 2017 from http://www.shapeamerica.org/advocacy/son/upload/Shape-of-the-Nation-2010-Final.pdf

National Center for Education Statistics. (2013). Institute of Education Sciences. Retrieved October, 2017 from http://www.nces.ed.gov/programs/digest/d13/tables/dt13-204.10asp

National Institute for Children's Health Quality. (2016). Obesity. Retrieved November, 2017 from https://www.nichq.org/search?terms=obesity&f%5B0%5D=topic%3A26

National Research Council. (2011). *Successful K-12 STEM education: Identifying effective approaches in science, technology, engineering and mathematics.* Washington, DC: The National Academies Press.

Nguyen, G., Bhawra, J., Cooke, M., Hanning, R., & Gonneville, S. (2016). Community perspectives on food insecurity and obesity: Focus groups with caregivers of metis and off-reserve first nations children. *International Journal for Equity in Health*, 14.

Nicklaus, S., & Remy, E. (2013). Early origins of overeating: Tracking between early food habits and later eating patterns. *Current Obesity Reports*, *2*, 179-184.

Ogden C., Lamb, M., Carroll, M., & Flegal, K. (2010). Obesity and socioeconomic status in children: United States 1988–1994 and 2005–2008. NCHS data brief no 51. Hyattsville, MD: National Center for Health Statistics.

Papoutsi, G., Drichoutis, A., & Nayga, R. (2013). The causes of childhood obesity: A survey. *Journal of Economic Surveys, 27*(4), 743-767.

Paruthi, S., Brooks, L., D'Ambrosio, C., Hall, W., Kotagal, S., Lloyd, R., … Wise, M. (2016). Recommended amount of sleep for pediatric populations: A consensus statement of the American Academy of Sleep Medicine. *Journal of Clinical Sleep Medicine, 12*(6), 785–786.

Pendergast, E., Lieberman-Betz, R., & Vail, C. (2017). Attitudes and beliefs of prekindergarten teachers toward teaching science to young children. *Early Childhood Education Journal*, *45*(1), 43-52. doi:10.1007/s10643-015-0761-y

Perera, T., Frei, S., Frei, B., Wong, S., & Bobe, G. (2015). Improving nutrition education in U.S. elementary schools: Challenges and opportunities. *Journal of Education and Practice, 6*(30), 41-50.

Phipps, E., Braitman, L., Stites, S., Singletary, S.,Wallace, S., Hunt, L., & Uplinger, N. (2015). Impact of a rewards-based incentive program on promoting fruit and vegetable purchases. *American Journal of Public Health, 105*(1), 166-172.

Physical Education. (2017). *Funk & Wagnalls New World Encyclopedia*, 1p.1.

Plourde, L. (2002). The influence of student teaching on pre-service elementary teachers' science self-efficacy and outcome expectancy beliefs. *Journal of Instructional Psychology, 29*(4), 245-252.

Pont, S., Puhl, R., Cook, S., & Slusser, W. (2017). American Academy of Pediatrics section on obesity, the obesity society: Stigma experienced by children and adolescents with obesity. *Pediatrics*, *140*(6), 1-11.

Puhl, R., & Luedicke, J. (2012). Weight-based victimization among adolescents in the school setting: Emotional reactions and coping behaviors. *Journal of Youth Adolescence, 41*(1), 27-40. doi:10.1007/s10964-011-9713-z.

Raistenskis, J., Sidlauskiene, A., Strukcinskiene, B., Ugur Baysal, S., & Buckus, R. (2016). Physical activity and physical fitness in obese, overweight, and normal-weight children. *Turkish Journal of Medical Sciences, 46,* 443-450. doi:10.3906/sag-1411-119.

Robert Wood Johnson Foundation. (2016). Declining Childhood Obesity Rates Brief. Retrieved September, 2017 from http://rwfj.org

Savage, J., Fisher, J., & Birch, L. (2007). Parental influence on eating behavior. Conception to Adolescence. *Journal of Law, Medicine, & Ethics*, *35*(1), 22-34.

Scharf, R., & DeBoer, M. (2015). Sleep timing and longitudinal weight gain in 4- and 5-year-old children. *Pediatric Obesity*, *10*(2), 141-148. doi:10.1111/jipo.229

Schulz, H., & Salzarulo, P. (2016). The development of sleep medicine: A historical sketch. *Journal of Clinical Sleep Medicine*, *12*(7), 1041-1052.

Schwarzfischer, P., Weber, M., Gruszfeld, D., Socha, P., Luque, V., Escribano, J., … Grote, V. (2017). BMI and recommended levels of physical activity in school children. *BMC Public Health*, *17*, 595. doi:10.1186/s12889-017-4492-4

Schwebel, M. (1979). Review of mind in society: The development of higher psychological processes. *American Journal of Orthopsychiatry*, *49*(3), 530-536. doi:10.1111/j.1939-0025.1979.tb02640.x

Sheldon, S. (2015). Sleep education in schools: Where do we stand? *Journal of Clinical Sleep Medicine*, *11*(6), 595-596.

Songer, N., Lee, H., & Kam, R. (2002). Technology-rich inquiry science in urban classrooms: What are the barriers to inquiry pedagogy? *Journal of Research in Science Teaching*, *39*(2), 128-150.

Spiegel, K., Tasali, E., Penev, P., & Van Cauter, E. (2004). Brief communication: Sleep curtailment in healthy young men is associated with decreased leptin levels, elevated ghrelin levels, and increased hunger and appetite. *Annals of Internal Medicine*, *141*(11), 846-850.

Story, M., & Kaphingst, K.M. (2009). Child care as an untapped setting for obesity prevention: State child care licensing regulations related to nutrition, physical activity, and media use for preschool-aged children in the United States. *Preventing Chronic Disease*, *6*(1), A11.

Taheri, S., Lin, L., Austin, D., Young, T., & Mignot, E. (2004). Short sleep duration is associated with reduced leptin, elevated ghrelin, and increased Body Mass Index. *PLoS Medicine*, *1*(3), 262.

The Office of Disease Prevention and Health Promotion. (2016). History of physical activity recommendations and guidelines for Americans. Retrieved August, 2018 from https://health.gov/paguidelines/second-edition/meetings/1/History-of-Physical-Activity-Recommendations-and-Guidelines-for-Americans.pdf

The White House. (2017). President Trump signs memorandum for STEM education funding. Retrieved October, 2017 from https://www.whitehouse.gov/blog/2017/09/26/president-trump-signs-memorandum-stem-education-funding

Tippett, C. D., & Milford, T. M. (2017). Findings from a pre-kindergarten classroom: Making the case for STEM in early childhood education. *International Journal of Science and Math Education, 15*(1), S67-S86.

Trust for America's Health & Robert Wood Johnson Foundation. (2013). F as in fat: How obesity threatens America's future. Retrieved September, 2017 from http://stateofobesity.org/files/fasinfat2013.df

Trust for America's Health & Robert Wood Johnson Foundation. (2016). The state of obesity in Mississippi. Retrieved September, 2017 from http://stateofobesity.org

Tu, T. (2006). Preschool science environment: What is available in a preschool classroom? *Early Childhood Education Journal*, *33*, 245-251.

United States Census Bureau. (2016). Number of people living in poverty areas - American Community Survey. Retrieved July, 2018 from https://www.census.gov/programs-survey/acs/

United States Census Bureau. (2014). Number of people living in 'Poverty Areas' up, Census Bureau Reports. Retrieved February, 2018 from https://www.census.gov/newsroom/press-releases/2014/cb14-123.html

United States Department of Agriculture. (2008). Economic Research Service (ERS). Can low-income Americans afford a healthy diet? Retrieved November 21, 2017 from https://www.ers.usda.gov/amber-waves/2008/november/can-low-income-americans-afford-a-healthy-diet/

United States Department of Agriculture. (2017). School meals: Healthy Hunger-Free Kids Act. Retrieved February, 2018 from https://www.fns.usda.gov/school-meals/healthy-hunger-free-kids-act

United States Department of Agriculture. (2017). Center for Nutrition Policy and Promotion: MyPlate/MiPlato. Retrieved February, 2018 from https://www.cnpp.usda.gov/MyPlate

United States Department of Agriculture. (2018). What is MyPlate? Food guide history. Retrieved February, 2018 from https://www.chosemyplate.gov/MyPlate

United States Department of Agriculture. (2018). Women, Infants, and Children. Retrieved July, 2018 from www.fns.usda.gov/wic/women-infants-chidren-wic

United States Department of Education. (2015). Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2009 and 2015 Science Assessments. Retrieved October, 2017 from https://nces.ed.gov/nationsreportcard/subject/publications/stt2015/pdf/2016157MS4.pdf

United States Department of Health and Human Services. (2010). Healthy People 2020. Retrieved August, 2018 from https://healthypeople.gov/2020/topics-objectives

United States Department of Health and Human Services. (2015). Centers for Disease Control and Prevention, National Center for Health Statistics data brief 219. Retrieved February, 2018 from https://www.cdc.gov/nchs/data/databriefs/db219.pdf

United States Department of Health and Human Services. (2017). President's Council on Sports, Fitness & Nutrition: Facts & statistics. Retrieved October, 2017 from https://www.hhs.gov/fitness/resource-center/facts-and-statistics/index.html

Uyanik, G. (2016). Investigation of the self-efficacy beliefs in teaching science and attitudes towards teaching profession of the candidate teachers. *Universal Journal of Educational Research, 4*(9), 2119-2125. doi:10.13189/ujer.2016.040924

World Health Organization. (2010). Global recommendations on physical activity for health. Geneva. Retrieved September, 2017 from http://www.who.int/dietphysicalactivity/factsheet_recommendations/en/

World Health Organization. (2017). Commission on Ending Childhood Obesity (ECHO). Geneva. Retrieved September, 2017 from http://www.who.int/end-childhood-obesity/news/public-consultation-2017/en/

Wright, T., & Gotwals, A. (2017). Supporting kindergarteners' science talk in the context of an integrated science and disciplinary literacy curriculum. *The Elementary School Journal*, *117*(3). Retrieved October, 2017 from http://www.journals.unchicago.edu/t-and-c

Yildiz-Duban, N., & Gokcakan, N. (2012). Classroom teacher candidates' attitudes towards teaching profession and self-efficacy towards science teaching. *Institute of Social Science Journal*, *21*(1), 267-280.

Young Men's Christian Association. (2011). The YMCA's family health snapshot. Chicago, IL. Retrieved July, 2018 from http://www.ymca.net/news-releases/ymca-survey-finds-u-s-parents-not-making-kids-health-top-priority

Zhai, J., & Tan, A. (2015). Roles of teachers in orchestrating learning in elementary science classrooms. *Research Science Education*, *45*, 907-926. doi:10.1007/s11165-014-9451-9

Zygmunt-Fillwalk, E., & Bilello, T. (2005). Parents' victory in reclaiming recess for their children. *Childhood Education*, *82*(1), 19-23.

# CHAPTER II

# *WANNABEE HEALTHY? BE SMART! BE ACTIVE! BE A LEADER!* CURRICULUM IMPLEMENTATION

## Abstract Manuscript 1

The number of activities within each curriculum domain (i.e., books, creative expression, language/literacy, math, science) and the amount of activities within each theme of the lessons (i.e., nutrition, physical activity, sleep) utilized by participating teachers in the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science curriculum was examined. Prior to implementation, teachers (*N* = 68; *M* age = 35.5 years old) attended a one-hour training where use of the curriculum and the resource toolkit of supplemental materials was demonstrated. Teachers were given the option to complete the two-week curriculum over the course of a month. To measure curriculum domain and theme dosage, teachers completed a curriculum usage checklist, marking "Y+" if they implemented the activity in their classroom and would likely use it again, "Y-" if they implemented the activity in their classroom and would not use it again, or "N" if they did not implement it during the four-week period. An overall total number of activities and a total number of activities within each curriculum domain (e.g., creative expression) and within each theme (e.g., nutrition) was calculated using a frequency analysis. Results show that over 20% of reporting teachers (*n* = 10; 21.8%) implemented all or almost all (i.e., 49 or 50) of the curriculum's 50 activities. Students had the most exposure to the book domain, as 73.9% of participants (*n* = 34) acknowledged reading at least one book and a majority (*n* = 24; 52.2%) incorporated all 10 into the instructional period. Teachers registered less usage

in the math domain, where 30.4% ($n$ = 14) did not implement any section of that curriculum area. Teachers implemented more of the nutrition-themed activities with 73.9% ($n$ = 34) including at least one lesson throughout the month. Children were engaged in fewer sleep activities than any of the three themes.

## Manuscript 1

Young children are naturally curious, persistently seeking answers to relentless questions and continuously examining their environment. Some would argue that they come into this world equipped with instincts of mini-scientists. Their inquisitive nature gives early childhood classrooms the ideal platform for a learning atmosphere that introduces and promotes science education and discovery. The U.S. Department of Education, the National Association for the Education of Young Children (NAEYC), and numerous researchers confirm the importance of incorporating science, especially STEM (Science, Technology, Engineering, and Math) into an early childhood curriculum (Evangelou, 2010; McLean et al., 2015; National Science Teachers Association, 2014; Tippett & Milford, 2017; Wilson-Lopez & Gregory, 2015;) where children can be encouraged to explore, investigate, problem solve, and share ideas. In fact, Dejonckheere and colleges (2016) found that by engaging 4-6 year olds in intentional inquiry-based activities, children become more exploratory and information seeking during play, fostering the early emergence of important reasoning skills needed to be a successful science learner. Exposure to such surroundings not only encourages scientific thinking and boosts science conceptual knowledge later in life but provides other abilities (e.g., critical thinking, inferring, understanding expository text) needed to prosper in other curriculum domains, such as reading and math (Chung & Keckler, 2016; Eshach & Fried, 2005; Haury, 2001; Songer et al., 2002; Zhai & Tan, 2015). Perhaps by cultivating students' positive engineering perception and highlighting various STEM career fields within early childhood classrooms, preconceived societal biases toward science professions can also be lessened, inspiring a more diverse future work force for science (National Research Council [NRC], 2011).

Contrary to evidence on the impact STEM and science learning has on young students, few opportunities are offered during early childhood programs (Nayfeld et al., 2011; Tu, 2006). Teachers tend to shy away from incorporating science discussions into their daily instructional routines. Some suffer from feelings of their own inadequacy to teach on the topic, while others succumb to the pressure of focusing attention on other subjects deemed more important to a student’s school success, such as literacy and mathematics (Lee & Shea, 2016; Pendergast et al., 2017; Zhai & Tan, 2015). Teachers are finding it difficult to fit science, as it competes with other “essential” subjects, into their already crowded lesson plans (Perera et al., 2015). In fact, the 2012 National Survey of Science and Mathematics Education (Horizon Research, 2013) reported time spent on task for science in pre-kindergarten through third grades averaged 19 minutes per day, compared to 89 minutes in language arts and 54 minutes in math. Time on task mirrors data collected showing teachers perceive highest levels of self-efficacy in literacy than in math, and lowest in the field of science (Gerde et al., 2018). Although Pendergast’s research team (2017) found that early childhood teachers’ perceptions toward teaching science have improved and they may be better prepared now than prior years, teachers are still expressing self-doubt in their instructional efficacy and their ability to support children as they begin to think and question scientifically.

Despite the awareness that children are born natural scientists and current research endorsing the importance of science-related discussions at a young age, early childhood programs frequently neglect including it into their curriculum. In order to diminish the obstacles of teaching science that teachers encounter, whether self-efficacy or scheduling constraints, scholars promote an integration approach where science can be effectively infused into other curriculum domains: language, math, and social studies (Chung & Keckler, 2016; Dudley et al., 2015; McLean et al., 2015; Tippett & Milford, 2017; Wright & Gotwals, 2017). Simply put, science instruction does not necessarily have to be taught as a stand-alone course but could be interwoven into reading and math activities or other content area discussions that take place during the entire school day (Gerde, 2013). In fact, the Common Core Learning Standards (CCLS) and the National Association for the Education of Young Children (NAEYC) both encourage integrating skills into other content areas in hopes of exposing students to as many experiences as possible, encouraging success across multiple subject areas. Chung and Keckler (2016) found that by using science-themed books during literacy instruction, they were able to increase process thinking skills in both reading and science. Integration of subject matter offers an additional benefit such as providing early childhood teachers the ability to teach in one content area where they feel confident while linking to the less familiar science curriculum. McLean et al. (2015) found that teachers gained self-assurance and competence in teaching science through the use of children's literature. Since the basis of science activities rely heavily on foundational skills important for other curriculum domains (i.e., compare and contrast, acquire and apply new vocabulary, communicate ideas, draw conclusions), it is advantageous to integrate skills throughout meaningful contexts across all curriculum domains.

To address this need, a STEM-focused health science curriculum for pre-kindergarten and kindergarten children was created at Mississippi State University through funding provided by the National Institutes of Health Science Education Partnership Award. The *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science curriculum provided teachers with 50 activities that aligned with the Mississippi Early Learning Standards (MSELS), Next Generation Science Standards (NGSS) for kindergarten, and the Centers of Disease Control and Prevention (CDC) National Health Education Standards. The integrated curriculum provided health science education (i.e., nutrition, physical activity, and sleep health education) across books, creative expression, language/literacy, math, and science domains. The goal of the curriculum was to foster an increase in early STEM education in Mississippi while improving health habits of young children and ultimately decreasing obesity rates.

### New Directions

In the present study, we strive to expand literature on teacher implementation of an integrated healthy habits curriculum by evaluating dosage and type of activity implementation by participating teachers. The *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* curriculum was designed to offer participating teachers a detailed plan to help incorporate health science-themed activities into their instruction with the ease of little to no preparation time. While research supports the value of teaching science in early childhood programs (Evangelou, 2010; McLean et al., 2015), many teachers find it difficult to incorporate into their instructional day (Lee & Shea, 2016; Pendergast et al., 2017), warranting an examination of implementation to further advance prior work conducted in this area.

Using secondary data stemming from the original evaluation study on the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science curriculum, this study set out to determine (1) the curriculum dosage implemented by teachers during the four-week timeframe, (2) the quantity of activities within each of the curriculum domains (i.e., books, creative expressions, language/literacy, math, science) implemented, and (3) the number of activities within each theme (i.e., nutrition, physical activity, sleep) executed by participating teachers in the *WannaBee Healthy? Be Smart! Be Active! Be a Leader! health* science curriculum evaluation.

It is hypothesized, because of existing evidence, that teachers will implement fewer science domain activities than other curriculum domains due to lower self-confidence in science proficiency of early childhood teachers (Pendergast et al., 2017). Conversely, it is expected that curriculum lessons focusing on literacy will be used most by teachers given the academic focus on literacy in the early public schooling years (Horizon Research, 2013). Additionally, it is expected that children will be exposed to more nutrition information than physical activity or sleep, given that the curriculum included a substantial focus (86%) on nutrition.

## Method

### Participants

Pre-k and kindergarten teachers (*N = 68*) from public school systems in a 20-county region in North Mississippi implemented the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science curriculum in their classrooms. Of the participating teachers, 57 completed and returned a curriculum usage checklist (83.8% response rate). The average age of the participating teachers was 35.5 years (*SD = 9.3 years*), and the majority of the sample was Caucasian (78.9%) and female (98.2%). All 68 teachers were employed in one of the 20 Mississippi school districts that agreed to participate in the program during one of three implementation semesters. The school districts were located within one of the following counties: Alcorn, Benton, Calhoun, Chickasaw, Clay, Itawamba, Lafayette, Lee, Lowndes, Marshall, Monroe, Montgomery, Oktibbeha, Panola, Pontotoc, Prentiss, Tippah, Tishomingo, Union, or Webster.

## Procedures

This study utilized secondary data from a larger study that employed a waitlisted comparison group design to evaluate the effectiveness of the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* curriculum on improving children's healthy habits knowledge. Only the procedures applicable to the current study are detailed below. The study was approved by the institution's Internal Review Board (IRB), and participating schools and teachers provided consent.

Preceding implementation of the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science curriculum, participating teachers attended a one-hour introduction to the curriculum and were provided a resource toolkit that contained items needed to implement the curriculum (e.g., food models, books). During this introduction training, teachers were provided guidance on how to effectively utilize the program along with the accompanying resource toolkit of supplemental materials and ideas within their classroom. Teachers were given the opportunity to ask questions in addition to instructions on how to document their implementation in the classroom. Teachers were informed that they would have the option to complete the two-week curriculum within a one-month period and that researchers would collect their documentation following the month timeframe.  Programming and collection of data transpired over three semesters (i.e., fall 2014, spring 2015, fall 2015), with school implementation assignments based on when the teacher training occurred.

## Measures

### *Curriculum Usage Checklist*

The curriculum usage checklist was created for the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* project and was completed by teachers to record the curriculum lessons that they chose to implement within their classroom over the course of the intervention month. The checklist consisted of a table with five rows, each representing a curriculum domain (i.e., books, creative expressions, language/literacy, math, science), and ten columns (each representing a day of the school week across the two-week lesson plan). Of note, each lesson was linked to a specific domain but contained health-related theme(s) (i.e., nutrition, physical activity, sleep), as this is what made it an integrated curriculum. During the instructional period, the curriculum usage checklist was completed by the teachers to determine which of the 50 curriculum activities were implemented in the given timeframe. That is, if teachers implemented an activity and were likely to use it again, they were asked to document by circling a “Y+”. If they implemented the activity in their classroom and would not use it again, they were instructed to circle “Y-”. If they did not implement the activity during the intervention period, they circled “N” (See Appendix A for the curriculum usage checklist). All “Y” responses were coded as an implementation and all implementations were summed. A total number of activities implemented (i.e., 1- 50) and a total number of activities within each curriculum domain (i.e., books, creative expression, language/literacy, math, science) as well as within each theme (i.e., nutrition, physical activity, sleep) were summed, with higher scores representing more implementation (i.e., dosage) of the curriculum, a domain, or a theme.

### *Analysis Plan*

Frequency analyses were conducted on the curriculum usage checklist to determine the amount (dosage) of activities implemented by teachers across all domains within the four-week intervention window. Additionally, the frequency of implementation within the five domains (i.e., books, creative expression, language/literacy, math, science) and health themes (i.e., nutrition, physical activity, sleep) were calculated.

To determine the number of activities implemented that addressed nutrition, physical activity, and sleep, a series of steps were taken. First, each of the 50 activities were linked to themes: nutrition, physical activity, and sleep. That is, each activity was analyzed to determine if the activity included educational information on physical activity, sleep and/or nutrition. It was possible for each activity to include more than one theme and could include all three. Tallies were recorded for each of the three themes to generate a total number of possible curriculum activities related to that subject matter.

Next, it was determined how many themes were incorporated into each of the curriculum domains: books, creative expression, language/literacy, math, and science. For example, using the previously coded themes, a total number of books that addressed sleep were calculated in order to establish exactly how many books were available to teachers in the curriculum that focused on the topic of sleep health. This step was repeated again for books pertaining to both physical activity and nutrition and then again across each remaining domain.

Last, to determine the curriculum dosage across themes and domains, each teacher's curriculum usage checklist was examined. Each activity the teacher acknowledged using in the classroom, either with a "Y+" or "Y-", was then linked to the curriculum domain (i.e., books, creative expression, language/literacy, math, and science) and theme(s) (i.e., nutrition, physical activity, and sleep) contained in each activity, providing information on total number of themes within each curriculum domain he/she engaged students in over the course of the program month.

Statistical Package for Social Sciences (SPSS) software, version 25 was used to compute the descriptive statistics for each teacher involved in the intervention. That is, each teacher was given a frequency score for (1) curriculum dosage, (2) amount of activities implemented within each curriculum domain (i.e., books, creative expression, language/literacy, math, science), and (3) quantity of lesson implementation within each health theme (i.e., physical activity, sleep, nutrition).

## Results

### Curriculum Implementation

Teachers (*N* = 68), from 20 different schools within a 20-county region in North Mississippi, participated in the study to implement the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science curriculum, and 57 teachers returned the curriculum usage checklists. Of the 57 teachers who returned the survey, 11 did not complete the form (e.g., returned a blank checklist), which resulted in 46 checklists to evaluate for implementation.

Frequency analysis indicated a range of variability existed in implementation, with some teachers reporting full implementation and others reporting none (see Tables 1 and 2). Specifically, ten teachers (21.8%) implemented all or almost all (i.e., 49 activities) of the curriculum, with five teachers (10.9%) implementing all 50 curriculum activities. Similar numbers of teachers (i.e., *n* = 12; 26.1%) reported that they did not implement any activities over the course of the month. Approximately half of the sample (*n* = 24 teachers; 52.1%) reported implementing at least 1 activity, but fewer than 49 lessons, with four of those teachers implementing less than 50% of the potential 50 activities. Over the course of the month, teachers averaged implementing 27 (54%) of the 50 curriculum activities.

### Domain Implementation

Each of the five curriculum domains (i.e., books, creative expressions, language/literacy, math, and science) contained 10 activities (e.g., one book each day of the two-week curriculum). That is, over the course of the two-week curriculum, teachers had the opportunity to engage children in one lesson of each domain per day. The findings regarding each domain are presented below.

### *Books*

The majority (*n* = 29; 63.1%) of the 46 teachers who completed the curriculum checklist indicated that they read at least nine of the ten books in the curriculum, with the largest percentage (*n* = *24*; 52.2%) completing all ten over the course of the month. However, twelve teachers (26.1%) did not read any of the books during the reporting phase. The additional five participants (10.8%) read between two and eight books to their class within the month period. During the reporting month, teachers' averaged reading nearly seven books (6.8) out of the ten included in the curriculum.

### *Creative Expressions*

Results of the frequency analysis indicated that thirteen of the reporting teachers (28.3%) incorporated nine or ten of the creative expression activities into their instructional plan. However, the same percentage of teachers (*n* = 13; 28.3%) did not engage their students in any of the lessons during the month-long implementation period. Over 40% of teachers (*n* = 20; 43.4%) reported using more than one creative expression activity but fewer than nine in total. On average, teachers used five creative expression activities from the curriculum during the implementation period.

### *Language & Literacy*

More than a quarter of the teachers (*n* = 13; 28.2%) reported utilizing at least nine of the lessons within the language and literacy domain, and ten of those teachers (21.7%) implemented every one of the lessons. Almost half (*n* = 21; 45.7%) of the teachers implemented at least one of the language and literacy domain lessons within the reporting period, yet 12 teachers (26.1%) did not teach any of the language and literacy lessons in their classrooms. Of the ten language and literacy lessons included in the two-week curriculum, teachers averaged implementing five of the activities over the month-long period.

### *Math*

Regarding the math domain, twelve teachers (26.1%) implemented all ten lessons, with an additional three teachers (6.5%) implementing nine of the ten math lessons. That is, 32.6% of the teachers (*n* = 15) included all or nearly all of the math focused lessons in their instructional plan throughout the month. Just over 30% (*n* = 14; 30.3%) did not employ any of the lessons from the math domain during the month. The remaining 17 teachers (37.1%) reported domain usage ranging from one to eight lessons during the documentation period. An average of five lessons from the math domain was implemented by teachers over the course of the month.

### *Science*

Just over 25% of reporting teachers (*n* = 12; 26.1%) implemented nine or ten of the science-related lessons, and 11 of those teachers (23.9%) implemented all ten. More than a quarter of participating teachers (*n* = 12; 26.1%) did not engage students in any of the ten science activities, yet the remaining teachers (*n* = 22; 47.8%) implemented from one to eight science activities during the reporting period. Teachers implemented an average of five science activities from the curriculum during the intervention.

## Theme Implementation

The three health themes (i.e., nutrition physical activity, sleep) were integrated throughout all domains of the curriculum. Calculations of the breadth of the exposure to each theme a classroom received was derived. The results of the frequency analysis are provided in the below paragraphs.

### *Nutrition*

Nutrition education, the health focus of the curriculum, was included in 43 of the 50 potential activities or 86% of the curriculum. Of the reporting teachers, 34 (73.9%) acknowledged implementing at least one nutritional lesson from the curriculum. Approximately 25% of the teachers (*n* = 12; 26.1%) indicated that no nutrition education had taken place in their classroom over the month reporting period, whereas 21.8% of teachers (*n* = 10) reported implementing at least 42 nutrition activities. If teachers implemented any of the nutrition lessons, they reported to have engaged children in no less than seven activities that provided nutrition education. The teachers averaged implementing 24 nutrition-themed activities from the curriculum's 43 lessons (55.8%) over the course of the month.

### *Physical Activity*

A total number of 12 physical activity lessons were integrated into the curriculum. Results showed that ten teachers (21.7%) indicated that they engaged students in all physical activity lessons of the curriculum, with 33 teachers (71.7%) implementing at least one. Of the reporting teachers, 13 (28.3%) did not include any of the physical movement activities into their instruction over the course of the month. Teachers implemented an average of six physical activities, which is 50% of the physical science curriculum, during the month timeframe.

### *Sleep*

Sleep was only addressed in 3 of the 50 curriculum lessons. The majority of teachers (*n* = 30; 65.2%) implemented at least one of the sleep activities over the course of the month, with 21

(45.7%) of those conducting all 3 into their classroom lessons. A large percentage (*n* = 16; 34.8%) did not include any sleep education from the curriculum.

## Discussion

The aim of this project was to gain better understanding about teacher implementation of curriculum domains (i.e., books, creative expression, language/literacy, math, and science) and themes (i.e., nutrition, physical activity, and sleep) within the context of an integrated health science curriculum for pre-kindergarten and kindergarten classrooms. Findings indicated that teachers fell short of full implementation of the curriculum, with less than 25% implementing all 50 of the activities. This finding highlights the difficulty many teachers have with incorporating additional content into their instructional day (Perera et al., 2015), on top of what they are expected to do in the public school system, even in pre-kindergarten and kindergarten classrooms. Though school districts vary in their curriculum choices and pacing guides of specific skill mastery per nine-week periods, they all have policies and procedures that teachers must follow. While teachers were given the choice of "if and when" to implement components of the *WannaBee Healthy?* curriculum over the course of the month, they quite possibly struggled with imbedding additional activities into their daily instructional schedule, even if the activities were integrated across various content areas and teachers were provided all of the necessary materials for implementation.

Additionally, teachers' failure to implement the entire curriculum is reason for concern given the importance of exposing students to engaging, hands-on activities that encourage discovery and exploration (NAEYC, 2018) while building on previous discussions. The *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* curriculum was designed explicitly for early childhood teachers to include health science education throughout the day among multiple discussions, across different domains. Creators took great care to incorporate activities that not only met state and national science standards but that also provided developmentally appropriate play-based activities for young children. The objective was to increase child health science knowledge, but if only portions of the curriculum were implemented, students would fail to benefit from the consistent health-related discussions provided by the curriculum during each day of the implementation month. Based on Vygotsky's zone of proximal development (Schwebel, 1979), children need to be engaged in purposeful activities that encourage interactions and reinforces support for mastery of new skills. If teachers did not utilize the entire program, they impeded student access to purposeful lessons, and it could have negatively impacted student outcomes, giving the impression that the curriculum was ineffective.

It was not surprising that of all the domains, the books were the most consistently used. Many early childhood classrooms have literature circle or reading times already scheduled into their daily routines, thus perhaps it was easier for teachers to include the *WannaBee Healthy?* book of the day during that preexisting time slot than it was to arrange their lesson plans to include additional activities, such as science. Due to already established schedules, teachers may have faced challenges to include the science activity, seeing that a large number of early childhood programs lack science instruction in their daily routines (Tu, 2006).

Also worth noting is the ease of reading a book versus preparing for a lesson that has multiple components. For example, instruction that includes creating a graph or role-playing with finger puppets would require an additional preparation time (e.g., gathering materials, buying needed supplies, creating props), whereas reading a book, especially if the book has been provided for you, would not require preliminary planning before implementation. Furthermore, the book domain is a relatively "clean" activity for students, unlike activities that include cutting and pasting or incorporate mediums such as clay or playdoh, which can require teacher clean-up afterwards. The simplicity of fitting the reading of a book into classroom routines and requiring little preparation or follow-up actions could have attributed to books being the most implemented of all the five curriculum domains.

However, an unexpected finding was that teachers implemented similar numbers of activities from the science and literacy/language domains. Given prior research, we expected that teachers would implement fewer lessons with a science-related focus (Pendergast et al., 2017) and concentrate more on literacy-based activities, as that is the domain Gerde and associates (2018) found teachers to be most confident and comfortable teaching. This finding could be an effect of books being considered a standalone curriculum domain, or it could be an effect of the type of science activities included in the curriculum. For instance, all ten science lessons contained activities where children could be actively engaged. One lesson allowed students to examine foods using a magnify glass, while another had students identifying the amount of sugar in a variety of different drinks. Perhaps when teachers did find opportunities to include additional activities into their predetermined schedule, they chose inquiry-based activities that would not only interest students, but provide much needed experiences to encourage learning (Eshach & Fried, 2005).

Although the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science curriculum did offer a variety of hands-on activities promoting active engagement by students, there was an imbalance in the amount of activities within certain themes. For example, the curriculum was saturated with nutrition-associated lessons, but included little information on physical activity or sleep education. The curriculum's extensive focus on nutrition falls into step with today's educational practices to concentrate on nutrition since it has been a component of health education for over a century (Means, 1975). Though educators tend to believe offering recess or having a physical education class period is sufficient, current research indicates that discussing the importance of being active with students is also important (Sun et al., 2012). Including sleep education into health curricula is a relatively new component as researchers have just recently begun understanding the importance of incorporating sleep discussions into early childhood classrooms and the impact it can have on future behaviors among children (Blunden & Rigney, 2015; Sheldon, 2015). With teachers having the ability to choose activities to implement in classrooms and given the limited options within certain themes (e.g., sleep), it is likely that some students could have little to no exposure to sleep and physical activity discussions over the course of the reporting period.

Perhaps a way to promote teacher buy-in and encourage improved implementation practices is to offer training that goes beyond an hour introduction. The training could be offered as a professional development seminar where teachers are informed on research supporting the program, along with ideas on how to accommodate activities for all levels of learners in their classrooms. By providing teachers the opportunity to practice teaching lessons, supplying understanding of the program, and offering ways to effectively implement the curriculum into their classrooms, teachers may feel more confident in their ability to develop health-habits among their students.

## Limitations

The teacher usage checklist was a crucial component of the examination of curriculum domain and theme dosage. The large number of participating teachers who returned blank checklists to researchers is troubling. It is unclear if those teachers neglected to implement any curriculum lessons or simply forgot to fill it out each day, and then by the end of the month, had forgotten what had been implemented. Whatever the reason, incomplete curriculum usage checklists hindered collecting accurate results and may have resulted in underreported usage of activities. That is, implementation may have been greater across all activities, but no documentation exists to support that.

Layout of the teacher usage checklist is another component identified as a limitation. Each curriculum domain (i.e., books, creative expressions, language/literacy, math, science) was represented equally, one for each day of the two-week lesson plan. Books were listed along the top of the checklist and science was listed along the bottom. Although each domain contained ten options, the presentation order of the curriculum was not randomized, so it is possible that teachers started instruction for the day at the top of the checklist, not only out of ease of reading a book, but also because it was the first thing they saw each day. That is, the order of listed domains could have influenced implementation if teachers began at the top and progressed down the list, including as many lessons as they could fit into their daily schedule. Therefore, it is conceivable that teachers implemented less science activities than books due to their inability to make it to the bottom of the usage checklist each day.

Time is also considered a limitation. Teachers were given the month timeframe in which to implement the program, however were not allowed to choose the 30-day period during the semester. Perhaps if they had been allowed to select the date for their classroom participation, they may have chosen a time in the semester that they considered to be less hectic. Another time limitation was that teachers were given the choice to implement over a two-week period or spread it out over the course of a month. The usage checklist did not provide a place for teachers to document which approach they used. Amount of lessons utilized could have possibly increased if participating teachers had been in control of when and for how long they were able to teach the curriculum in their classroom.

The sample size for this study was small. Information provided by the teacher usage checklist was examined for analysis, therefore receiving information on curriculum implementation was vital to the integrity of the evaluation. With a larger number of participating teachers, a more robust analysis could have been obtained due to more teacher reporting.

**Future Directions**

It is suggested that future investigation of the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* curriculum include a more comprehensive teacher training program. Perhaps an initial workshop on how to incorporate the lessons into daily routines along with demonstrations of how to successfully utilize the toolkit of materials and complete the usage checklist. Participants could then engage in follow-up cohort meetings where they are free to discuss their experiences and ask questions of fellow teachers. Cohort meetings could also provide a place where researchers could conduct brief teacher interviews to discuss obstacles with activity implementation, as well as offer technical assistance if needed.

Revision of the curriculum checklist is also advised. Randomized presentation would decrease the potential to influence implementation across the domains and negatively impact the outcome of results. Also recommended is balancing the amount of activities within each theme. Students should have the opportunity for equal exposure within each of the three: nutrition, physical activity, and sleep. With a larger sample size and participants given the freedom of selecting the date and length of implementation based on their classroom schedule, teachers may implement a larger number of activities, offering a more accurate analysis of the curriculum impact on child healthy habits knowledge.

**Summary**

These results confirm that many teachers are willing to implement health science activities into their daily schedule and provide important information for educators interested in creating or initiating an education program that focuses on building healthy habits among early childhood students. Through examination of teacher implementation, across domains and themes, this study contributes to our understanding of activities teachers more readily incorporate into their schedule, providing valuable insight for the development of future lessons. In addition, given that some of the teacher checklists were returned without being filled out, findings also suggest that teachers could use more flexibility in both the amount of time and dates within the school year in which they implement the curriculum. Although teachers are willing to implement an integrated health program, further investigation is necessary to gain deeper understanding of how to enhance the overall implementation among pre-kindergarten and kindergarten teachers.

## References


Blunden, S., & Rigney, G. (2015). Lessons learned from sleep education in schools: A review of dos and don'ts. *Journal of Clinical Sleep Medicine*, *11*, 671-680.

Chung, M., & Keckler, B. (2016). Shared-book experience using science-themed books to develop scientific literacy: An interactive approach with struggling readers. *The Language and Literacy Spectrum*, *26*, 31-40.

Common Core Standards Initiatives. (2016). *Read the Standards*. Retrieved June, 2018 from http://www.corestandards.org/ELA-Literacy/

Dejonckheere, P., De Wit, N., Van de Keere, K., & Vervaet, S. (2016). Exploring the classroom: Teaching science in early childhood. *International Electronic Journal of Elementary Education*, *8*(4), 537-558.

Dudley, D., Cotton, W., & Peralta, L. (2015). Teaching approaches and strategies that promote healthy eating in primary school children: A systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, *12*, 28.

Eshach, H., & Fried, M. (2005). Should science be taught in early childhood? *Journal of Science Education and Technolog*y, 14, 315-336.

Evangelou, D. (2010). Child development perspective in engineering education: Why STEM now? *Early Childhood Research and Practice*, *12*(2).

Gerde, H., Schachter, B., & Wasik, B. (2013). Using the scientific method to guide learning: An integrated approach to early childhood curriculum. *Early Childhood Education Journal 41*, 315-323.

Gerde, H., Pierce, S., Lee, K., et al. (2018). Early childhood educators' self-efficacy in science, math, and literacy instruction and science practice in the classroom. *Early Education and Development*, 1-21.

Haury, D.I. (2001). Teaching science through inquiry with archived data. Columbus, OH: ERIC Clearinghouse for Science Mathematics and Environmental Education. (ED465545)

Horizon Research. (2013). Report of the 2012 national survey of science and mathematics education. Chapel Hill, NC: NSSME.

Lee, C., & Shea, M. (2016). An analysis of pre-service elementary teachers' understanding of inquiry-based teaching. *Science Education International*, *27(*2), 217-237.

Means, R. (1975). *Historical Perspectives on School Health*. Thorofare, N.J.: Charles B. Slack.

McLean, K., Jones, M., & Schaper, C. (2015). Children's literature as an invitation to science inquiry in early childhood education. *Australasian Journal of Early Childhood*, *40*(4), 49-56.

National Association for the Education of Young Children. (2013). NAEYC early childhood program standards and accreditation criteria & guidance for assessment. Retrieved August, 2018 from htpp://www.naeyc.org/files/academy/file/AllCriteriaDocument.pdf

National Association for the Education of Young Children. (2017). *The Case of Brain Science and Guided Play: A Developing Story*. Retrieved June, 2018 from htpp://www.naeyc.org/resources/pubs/yc/may2017/case-brain-science-guided-play

National Research Council. (2011). *Successful K-12 STEM education: Identifying effective approaches in science, technology, engineering and mathematics.* Washington, DC: The National Academies Press.

National Science Teachers Association. (2014). *Statement of Early Childhood Science Education*, Retrieved June, 2018 from http://www.nsta.org/about/positions/earlychildhood.aspx

Nayfeld, I., Brenneman, K., & Gelman, R. (2011). Science in the classroom: Finding a balance between autonomous exploration and teacher-led instruction in preschool settings. *Early Education and Development*, *22*, 970-988. doi:10.1080/10409289

Next Generation Science Standards Lead States (2013). *Next generation science standards: For states, by states*. Washington, DC: National Academies Press.

Pendergast, E., Lieberman-Betz, R., & Vail, C. (2017). Attitudes and beliefs of prekindergarten teachers toward teaching science to young children. *Early Childhood Education Journal*, *45*(1), 43-52. doi:10.1007/s10643-015-0761-y

Perera, T., Frei, S., Frei,, B., Wong, S., & Bobe, G. (2015). Improving nutrition education in U.S. elementary schools: Challenges and opportunities. *Journal of Education and Practice, 6*(30), 41-50.

Schwebel, M. (1979). Review of mind in society: The development of higher psychological processes. *American Journal of Orthopsychiatry, 49*(3), 530-536. doi:10.1111/j.1939-0025.1979.tb02640.x

Sheldon, S. (2015). Sleep education in schools: Where do we stand? *Journal of Clinical Sleep Medicine, 11*(6), 595-596.

Songer, N., Lee, H., & Kam, R. (2002). Technology-rich inquiry science in urban classrooms: What are the barriers to inquiry pedagogy? *Journal of Research in Science Teaching, 39*(2), 128-150.

Sun, H., Chen, A., Zhu, X., & Ennis, C. (2012). Learning science-based fitness knowledge in constructivist physical education. *The Elementary School Journal*, *113*(2), 215-229. http://doi.org/10.1086/667405

Tippett, C. D., & Milford, T. M. (2017). Findings from a pre-kindergarten classroom: Making the case for STEM in early childhood education. *International Journal of Science and Math Education, 15*(1), S67-S86.

Tu, T. (2006). Preschool science environment: What is available in a preschool classroom? *Early Childhood Education Journal*, *33*, 245-251.

United States Department of Education. (2016). Open discussion on the role of education technologies in early childhood STEM education. Retrieved July, 2018 from https://sites.ed.gov/oese/2016/04/open-discussion-on-the-role-of-education-technologies-in-early-childhood-stem-education/

Wilson-Lopez, A., & Gregory, S. (2015). Integrating literacy and engineering instruction for young readers. *Reading Teacher*, *1*(25).

Wright, T., & Gotwals, A. (2017). Supporting kindergarteners' science talk in the context of an integrated science and disciplinary literacy curriculum. *The Elementary School Journal*, *117*(3). Retrieved October, 2017 from http://www.journals.unchicago.edu/t-and-c

Zhai, J., & Tan, A. (2015). Roles of teachers in orchestrating learning in elementary science classrooms. *Research Science Education*, *45*, 907-926. doi:10.1007/s11165-014-9451-9

# CHAPTER III

## IMPACT OF *WANNABEE HEALTHY? BE SMART! BE ACTIVE! BE A LEADER!* CURRICULUM ON CHILD OUTCOMES IN HEALTH KNOWLEDGE


### Abstract Manuscript 2

*WannaBee Healthy? Be Smart! Be Active! Be a Leader!* is a health science program that includes a two-week curriculum for early childhood, a customized classroom field trip to a health museum, and school to family workbooks that extend the lessons to home. The program in its' entirety was shown to be effective in improving children's health science knowledge (Cross et al., 2017). To further understand the role of the program components in increasing children's health knowledge, this study explored whether frequency and type of implementation of the curriculum in the early childhood classroom (pre-kindergarten and kindergarten) were associated with children's knowledge of (1) recognizing food from each of the five food groups, (2) creating a healthy plate that includes all recommended food groups, (3) identifying food origins, (4) choosing four activities that increase heart rate, and (5) equating sleep, a healthy plate and physical activity as behaviors needed to keep our body healthy. Teachers ($N$ = 68; $M$ age = 35.5 years old) implemented the program over the course of a month, documenting lessons utilized on a usage checklist as they proceeded through the curriculum. Out of 1,348 children exposed to the curriculum, pre- and post-assessments were conducted with a random sample of 252 pre-kindergarten (17.9%) and kindergarten (82.1%) students ($M$ age in years = 5.02) whose parents had provided consent. Teachers were given the choice

of implementation and thus the variation in the implementation of the curriculum (dosage) in addition to the number of activities implemented across the different curriculum domains (i.e., books, creative expressions, language/literacy, math, and science) and the resulting exposure to specific health themes (i.e., nutrition and physical activity) were examined as potential predictors of children's changes in health knowledge. ANOVA results indicated significant changes in at least one child assessment for four of the five domains and both of the health themes. Results indicated that the variation in curriculum dosage was not associated with changes in children's health knowledge when time between pre- and post-assessment were considered. Results suggest that the effectiveness of the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* program was not driven by the curriculum alone, but rather the combination of program components.

## Manuscript 2

The occurrence of obesity in America continues to remain strong; nearly 38% of adults and 17% of children are considered obese nationwide, with Americans weighing an average of 24 more pounds than they did in 1960 (Ogden et al., 2014; Trust for America's Health & Robert Wood Johnson Foundation, 2013 & 2016). Increased weight during childhood not only heightens future health issues such as diabetes and heart disease, but also can shorten life expectancy and create economic strains on U.S. populations (Finkelstein et al., 2009; Kitahara et al., 2014; Wang et al., 2011). With the increasing obesity rates in children, particularly Mississippian children where 27.4% ranging from 2 to 5 years old are obese and over 40% of school aged children and youth are either overweight or obese (Mississippi State Department of Health, 2013), reasons for concern continue to grow. That is, since the foundational characteristics of childhood eating patterns and habits remain fairly stable throughout adulthood (Nicklaus & Remy, 2013), and those early habits tend to predict future obesity trends and obesity-associated health conditions (Lo et al., 2015; Puhl and Luedicke, 2012), obesity is a grave concern for our society. Therefore, pre-kindergarten and kindergarten science programs that include teaching health-related topics such as nutrition (e.g., Why are carrots healthy for my body?) and the importance of engaging in physical activity (e.g., What happens to my heartrate when I run?) have a promising potential to significantly impact child growth and development.

Young children tend to be naturally curious, open to explore their environment and ask questions about their surroundings. It is their inquisitive disposition that creates an atmosphere within early childhood classrooms where science education and discovery can be successfully implemented. It is well established that incorporating science into early childhood programs that inspire and allow student observation, interpretation, and communication enhances a child's future science understanding, as well as builds skills (e.g., critical thinking, reasoning, interpreting) needed for success in other content areas (Eshach & Fried, 2005; Evangelou, 2010; McLean et al., 2015; National Science Teachers Association, 2014; Tippett & Milford, 2017; Wilson-Lopez & Gregory, 2015; Zhai & Tan, 2015). The Next Generation Science Standards, released in 2013, acknowledge the value of science instruction and advocate for all students, even the very young, to be included in hands-on, inquiry-based experiences such as gathering, analyzing, and interpreting data.

If numerous researchers, along with professional early childhood associations substantiate the benefits acquired by young children through science instruction, why is it that Tu (2006) found that many early childhood classrooms rarely include formal science lessons into their weekly plans? Two widespread explanations are commonly mentioned by teachers to support their lack of implementation. First, teachers have expressed doubts about their own science knowledge and perceive those limitations as roadblocks to effectively guide their young students on the path to scientific thinking (Lee & Shea, 2016; Pendergast et al., 2017). In fact, teachers that feel confident in their own science understanding, such as topics like STEM, tend to embrace student-centered, inquiry based activities into their schedule more openly (Plourde, 2002; Uyanik, 2016; Yildiz-Duban & Gokcakan, 2012). Second, science oftentimes is not emphasized with young students because it takes a backseat to other subjects deemed more important to the success of future student learning. For example, classroom teachers typically dedicate more time on activities that build literacy and mathematical skills, while forgoing the other "less important" curriculum domains such a science, social studies, and art (Horizon Research, 2013; Perera et at., 2015).

Whether the obstacles early childhood teachers face when involving students in structured science activities during their daily routines evolves from self-efficacy levels or added pressure to focus on other, more "important" content areas, the struggles are interfering with students' exposure to much needed science discovery lessons. The National Association for the Education of Young Children (NAEYC) recommends including science in early childhood programs and promotes combining it into class discussions in other subjects, otherwise known by educators as integration practices

(Gerde, 2013). Lesson integration is a method by which teachers can expose their students to a variety of topics across all domains (i.e., language arts, math, science, social studies, art), while also adhering to administrational demands of focusing on literacy or mathematics (Dudley et al., 2015; Tippet & Milford, 2017; Wright & Gotwals, 2017). That is, teachers do not have to fit a structured, stand-alone science lesson into their curriculum routines, instead they could immerse a science related topic, for instance health science or STEM, into other subjects or incorporate them into other components throughout the school day such as dramatic play, center time, or recess (Gerde, 2013). The Common Core Learning Standards (CCLS) supports cross curriculum integration since it allows teachers the opportunity to expand specific conversations to include multiple subject areas. In addition, it offers teachers the flexibility to implement science activities into a course content they may feel more proficient to teach. For example, teachers were found to gain self-efficacy in teaching science when they were able to link it to children's literature (McLean et al., 2015), which is the subject a majority of teachers feel the most confident teaching (Gerde et al., 2018). Since basic skills in science rely heavily on foundational skills from other curricula (e.g., observing, analyzing, inferring, communication), science instruction could have an important role in fostering success in other domains, such as reading or math (Chung & Keckler, 2016; Eshach & Fried, 2005; Haury, 2001; Songer et al., 2002; Zhai & Tan, 2015).

Pre-kindergarten and kindergarten early childhood programs that provide ways to integrate healthy practices and topics of STEM across curriculum discussions not only provide encouragement for healthy habits, but also offer modeling of health conscious practices and could diminish predetermined societal biases toward the STEM profession

(National Research Council [NRC], 2011). In addition, by exposing children to multiple discussions within several curricula domains during the day, children are exposed to the same information within different contexts. When children experience information repeatedly, even if stated somewhat differently at each encounter, additional opportunities are made available for them to “learn” that information. Pinkoski-Ball and associates (2012) discovered that children were more likely to accurately identify a greater number of words through speech reiterations and those identifications increased with additional exposure. In addition, if students are engaged in movement or hands-on activities that involve manipulating the skill set at other periods of the day, they are likely to remember the information but may also apply that information to other curriculum domains (French, 2004). Also worth considering is Howard Gardner’s Theory of Multiple Intelligences (1993) where eight different modalities of learning are identified: linguistic, logical-mathematical, spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, naturalist. In simplest terms, Gardner (1993) proposes that individuals learn through different learning intelligences and that one may remember information better if he or she was active with the information in music or movement, but others may remember it by simply hearing the verbal explanation. For example, when children use their auditory system to hear information during circle time, view and discuss a visual (e.g., graph that includes information) during math, manipulate a related matching game during center time, and act out connected characters through finger plays, they are not only encountering the information within other curriculums, but also within different learning intelligences. As you can see, by spreading science across many curriculum domains, children will experience an integrated process where a variety of activities are employed, with repeated exposure, thus meeting the needs of more children in a learning intelligence area that works best for them to be a successful science learner.

To help teachers with the struggles they face when trying to include science lessons into their instructional school day, Mississippi State University through funding provided by the National Institutes of Health Science Education Partnership Award developed a STEM-focused healthy science curriculum for pre-kindergarten and kindergarten programs. The *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science curriculum provided teachers with 50 activities aligned with the Mississippi Early Learning Standards (MSELS), Next Generation Science Standards (NGSS) for kindergarten, and the Centers of Disease Control and Prevention (CDC) National Health Education Standards. The curriculum's aim was to improve health habits of young children in Mississippi while encouraging a growth of STEM education within early childhood settings. The integrated curriculum provided health science education (i.e., nutrition, physical activity, and sleep health education) through the reading of books and across creative expression, language/literacy, math, and science domains.

**New Directions**

In the present study, we expand available literature on implementation of an integrated health science curriculum in pre-kindergarten and kindergarten classrooms by examining teachers' choice of dosage and type of activity implementation as it relates to changes in child heath knowledge. The *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* curriculum was created to offer teachers an integrated approach of infusing health-related topics into content area lessons with the ease of detailed lessons and limited teacher prep time. Given the obstacles teachers face while including science into their instructional day (Pendergast et al., 2017), an evaluation of teacher implementation is necessary to further advance prior work conducted in this area.

This study utilized secondary data from a larger study that employed a waitlisted control designed intervention to evaluate the effectiveness of the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* curriculum on increasing children's healthy habits knowledge within control and intervention groups. Funded by the National Institutes of Health Science Education Partnership Award, the health curriculum utilized an ecological systems theory approach to improve child health outcomes through multiple components: curriculum, teacher training, hands-on health museum fieldtrip, and family activity booklets. The original evaluation of the program indicated students who engaged in the program increased their knowledge of health science significantly more than students who did not participate (Cross et al., 2017). To further examine program effectiveness, in this study, we evaluated only the curriculum implementation to identify if it alone played a key role in child changes in health knowledge. Only the procedures applicable to the current study are detailed below. The study was approved by the institution's Internal Review Board (IRB), and participating schools and teachers provided consent.

Building on the first study in this dissertation and employing secondary data stemming from the original evaluation study on the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science curriculum, Study 2 (manuscript 2) assessed the associations between teacher use of the WannaBee Healthy? curriculum (i.e., frequency use of curriculum domains; frequency use of lesson themes) and child outcomes (e.g., USDA MyPlate accuracy). Namely, is the dosage and content (i.e., domains and health themes) of curriculum implementation related to children's ability to successfully (1) identify a food from each food group, (2) create a healthy MyPlate, (3) match foods with their origins, (4) recognize activities that increase heart rate, and (5) recognize sleep, healthy plate and physical activity as behaviors needed to keep our body healthy. The goal of this second study was to determine whether the teachers' choice in dosage and type of activity implementation of the *WannaBee Healthy?* curriculum was associated with children's specific types of gain in knowledge of health behaviors.

Based on available evidence that repeated exposure to content and higher rates of integrated lessons lead to greater knowledge change (Perera et al., 2015; Tippett & Milford, 2017), it is hypothesized that students who perform the best (e.g., able to recognize the healthiest MyPlate) on the child assessments will be those who were in classrooms in which more of the curriculum was implemented. Given the integrative nature of the curriculum, the rate of implementation within each of the curriculum domains is not expected to predict children's change in health knowledge, but greater exposure to specific health themes is expected to be directly related to child outcomes.

## Method

### Participants

Teachers (*N = 68*) of pre-kindergarten and kindergarten programs from public school systems in a 20-county region in North Mississippi implemented the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science curriculum, with 57 completing the usage checklist (83.8% response rate). The average age of participating teachers was 35.5 years (*SD = 9.3 years*). The majority of the teachers were Caucasian (78.9%) and female (98.2%). All participants taught in one of the 20 Mississippi school districts that agreed to join the program located within one of the following counties:

Alcorn, Benton, Calhoun, Chickasaw, Clay, Itawamba, Lafayette, Lee, Lowndes, Marshall, Monroe, Montgomery, Oktibbeha, Panola, Pontotoc, Prentiss, Tippah, Tishomingo, Union, or Webster.

Information from the curriculum usage checklist was employed to place teachers into one of four implementation groups (see Table 3). Based on the median number of activities teachers implemented (*Mdn* = 36), the following groups were created: (1) teachers who implemented none of the curriculum activities (*n* = 38), (2) teachers who implemented from 1 to 36 curriculum activities (*n* = 48), (3) teachers who implemented from 37 to 49 curriculum activities (*n* = 60), (4) teachers who implemented all of the curriculum activities (*n* = 21).

A total of 1,348 children were exposed to the curriculum during one of three implementation semesters. (i.e., fall 2014, spring 2015, and fall 2015). In each classroom, students were randomized, and 10% of students were drawn from each to participate in the pre- and post-assessments. The random sample (*N* = 252) consisted of 17.9% Pre-K students (*n* = 45) and 82.1% kindergarten students (*n* = 207). The mean age of the child sample was 5.02 years (*SD = .58*), and 48.4% of the students were female. The child sample was ethnically diverse, with 51.2% identifying as Caucasian, 42.5% as African American, 5.9% as Other, and .4% Asian.

**Procedures**

Secondary data from a larger, waitlisted control intervention designed to evaluate the effectiveness of the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science curriculum on improving children's knowledge of health habits was used. Only the procedures applicable to the current study are detailed. Approval was granted by the institution's Internal Review Board (IRB) and consent was provided by participating schools and teachers. Parents were informed in writing about the project and study with a request for participation. Once parents agreed, they were sent a consent form to sign, along with additional information about the pre- and post-assessments (i.e., dates of both assessments, approximate length of time their child would be out of the classroom, and the location where they were to be conducted).

Prior to implementation, participating teachers attended a one-hour professional development in-service on ways to effectively implement the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* curriculum. The training not only instructed teachers on ways to utilize the accompanying resource toolkit of supplemental materials (e.g., food models, books) but also discussed how to complete the curriculum usage checklist. Teachers were given the option to implement the curriculum program in their classrooms over a two- or four-week timeframe and were asked to complete a checklist of which activities they used in the classroom. Programming and data collection occurred over the course of three semesters (i.e., fall 2014, spring 2015, and fall 2015), with schools assigned an implementation time based on when the teacher training at that school was conducted.

Before program implementation, pre-assessments were conducted randomly on 10% of children from whose parents had provided consent. Post-assessments were then conducted on the same sample of children approximately six weeks after implementation. Individual child assessments were administered outside of the classroom (e.g., library) by a team consisting of two researchers. Children were asked a series of questions or completed performance tasks to assess children's health knowledge. If the target child was absent on either pre- or post-assessment day, they were not assessed and were excluded from the data set.

## Measures

### ***Teacher Implementation***

Teachers completed a curriculum usage checklist during the instructional period to record the specific curriculum activities in which they engaged their students. That is, if teachers implemented an activity and were likely to use it again, they were directed to circle a "Y+." If they implemented the activity in their classroom and would not use it again, they were instructed to circle a "Y-." If they did not implement the activity during the four-week period, they circled "N" (see Appendix A for the curriculum usage checklist). All "Y" responses were coded as implementation and received a score of 1, whereas "N" responses received a score of 0. Using this checklist, researchers derived a dosage rate, as well as the number of activities implemented within each curriculum domain (i.e., books, creative expressions, language/literacy, math, science) and the number of activities within each theme (i.e., nutrition, physical activity) of the 50 lessons implemented. Higher scores were representative of a greater dosage of the curriculum.

To obtain the number of activities within each domain and theme, every activity in the curriculum was reviewed to determine if it contained educational information on nutrition or physical activity. To generate a total number of possible curriculum activities related to each theme, tallies were recorded for each. It was then determined how many themes were incorporated into each of the curriculum domains: books, creative expression, language/literacy, math, and science. Using the same coding as with themes, it was established which books in the curriculum were available with a nutrition focus. This step was repeated again for books pertaining to both physical activity and then again across each remaining domain.

Teachers' usage checklists were explored to determine curriculum dosage per classroom across domains and themes. That is, each activity the teacher documented either with a "Y+" or "Y-," was then linked to the curriculum domain (i.e., books, creative expression, language/literacy, math, and science) and theme(s) (i.e., nutrition, physical activity) contained in each activity. This information allowed researchers to confirm the total number of themes within each curriculum domain in which he/she engaged students over the course of the program month. A total number of the 50 activities implemented, as well as a total number of activities within each curriculum domain (i.e., books, creative expression, language/literacy, math, science) and within each theme (i.e., nutrition, physical activity) were summed. Higher scores represent more exposure (i.e., dosage) to a domain or theme.

### ***Child Assessments***

To assess child knowledge, five assessments were developed specifically for this study. Each assessment was conducted before participation in the *WannaBee Healthy?* program and approximately six weeks ($M$ = 42.2 days) following participation. To uphold the integrity of the assessment process, pre- and post-tests were identical. All evaluations were conducted in a quiet location outside of the classroom and assessors ($n$ = 3) followed a script (see Appendix C). Below is a description of the five child assessments.

*Food Group Classification*. To determine if children gained knowledge in the ability to recognize foods that represent each of the five food groups, an assessment created by the research team using food picture cards was used. Ten cards were developed for the assessment; two cards from each food category: fruit, vegetable, grain, protein, and dairy. Students were asked to select and place a card in their shopping bag that would fit into each of the five food groups (e.g., Can you pick a fruit and put it in your shopping bag?). Students received a point for correctly identifying an item from each food group, with higher scores representative of more accurate identification.

*MyPlate Recommendations/Correct Section Match.* To establish if children increased knowledge in the ability to identify what constitutes a healthy plate, an assessment created by the research team using the USDA MyPlate model and ten printed food cards was used. Students were asked to create a healthy plate by selecting five items from the available food or drink cards and placing on a plastic plate that was segmented to represent the MyPlate diagram (see Appendix B). Possible food model choices consisted of cheese, milk, bread, rice, grapes, apple, carrots, broccoli, eggs, and a chicken leg. To evaluate children's ability to create a healthy plate, children were instructed to choose food from each of the five food groups and place them in the correct location on the plastic MyPlate diagram. This item was scored by assigning one point for each correct item placed on the MyPlate diagram, with higher scores reflecting greater knowledge of what makes a healthy plate. This assessment was conducted both prior to and following implementation of the curriculum.

*Food Origin.* To determine if students gained knowledge in recognizing where food comes from, the research team developed a matching activity where children were asked to link pictures of food (i.e., apple, carrot, chicken leg, milk, bread) to their origins (i.e., tree, garden, chicken, cow, wheat, grocery store, restaurant). Children were given one point for each of the five foods they matched correctly with its origin. Scores could range from 0 to 5 points, with higher scores indicative of greater knowledge of food origins.

*Recognition of Activities that Increase Heart Rate*. To verify if children increased knowledge in identifying types of activities that elevate heart rate, the research team designed a measurement modeled after Mobley and Evashevski's (2000) adapted version of the computerized Preschool Health and Safety Knowledge Assessment (PHASKA) where images of children doing ten different activities were displayed to the child. The researcher asked the child to select four of the activities that increase heartbeat. The four correct activities included jumping rope, riding a bike, running, and playing soccer. This assessment was scored by assigning one point to each active item that children selected, and zero points to the remaining six incorrect options: playing a video game, watching TV, playing on a computer, playing with toys, playing on the playground, and drawing. Higher scores reflected greater knowledge of activities that increase heart rate.

*Recognition of Healthy Body Needs.* To examine children's ability to recognize important habits that we need to keep our body healthy, the research team developed an assessment for children where they were shown images of seven children engaging in different types of behaviors. The behaviors depicted included a child playing soccer, sleeping, eating a candy bar, watching TV, eating a healthy plate, drinking a soda, and playing a video game. Children were given one point for each healthy behavior (i.e., playing soccer, sleeping, eating a healthy plate) they selected. The scores could range from 0 to 3, with higher scores indicative of greater knowledge of healthy behaviors.

### *Analysis Plan*

Statistical Package for the Social Sciences (SPSS) software, version 25 was used to compute all statistics involved in Study 2. Bivariate correlations were run to determine associations between study variables (see Table 1). Due to the large amount of domain and theme groupings ($n$ = 7) and to reduce the likelihood of Type 1 error, a series of one-way Analysis of Variances (ANOVA) was performed to better understand the relationship between teacher implementation (i.e., dosage and type) and differences in child knowledge (change scores). In addition, researchers conducted a Multivariate Analysis of Covariance (MANCOVA) to test for associations between curriculum implementation and child change scores while adjusting for the time between individual child pre- and post-assessments.

Growth of students' health knowledge was determined by subtracting pre-assessment scores from the post-assessment scores. Higher positive values represented larger improvements in health knowledge. Change scores were generated for each of the five child outcome measures (i.e., food groups, healthy plate, food origins, physical activities, healthy behaviors).

A series of one-way Analysis of Variances (ANOVA) was conducted to establish whether the variation in implementation within a curriculum domain (i.e., books, creative expressions, language/literacy, math, science) or within health themes (i.e., nutrition, physical activity) was related to each of the five children's outcome change scores. A total of eight ANOVAs were conducted. Additionally, a Multivariate Analysis of

Covariance (MANCOVA) was run to determine if groups based on teacher implementation were significantly associated with changes in children's health knowledge while controlling for time between child pre- and post-assessments.

## Results

Teachers (*n* = 68) from 20 different schools within a 20-county region in North Mississippi participated in the study to implement the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science curriculum in their classrooms. Out of participating teachers, 57 returned the curriculum usage checklists. From those received, 11 (19.3%) were left blank, leaving 46 completed checklists to examine for implementation. The average age of participating teachers was 35.5 years (*SD* = 9.3 years), and the majority of the sample were Caucasian (78.9%) and female (98.2%).

Children (*N* = 252) were randomly selected to participate in the child assessments. Of those selected, 165 had both pre- and post-assessments available. The average age of the assessed students was 5.02 (*SD* = 0.58), and the majority were kindergarteners (*N* = 207; 82.1%), Caucasian (*N* = 129; 51.2%), and male (*N* = 129; 51.2%).

### Preliminary Analyses

Pearson correlations among study variables are presented in Table 4. Strong, positive correlations were found regarding implementation across the curriculum and within the domains and themes. Child outcomes were highly associated with nutrition-themed activities, whereas three of the five assessments revealed at least 50% of the students had an increase in food-related change scores. The four teacher implementation group variables were not significantly correlated with any of the child outcome measures.

Teacher implementation totals for each domain and theme were not significantly associated to the grade the teacher taught, whether pre-kindergarten or kindergarten,

## Child Assessment Change Scores

To examine changes in children's health knowledge, change scores were derived for each of the five child assessments (i.e., food groups, healthy plate, food origins, physical activities, healthy behaviors). These scores were only available for the students who completed both the pre- and post-assessments (*n* = 165). Results of these analyses are provided below by assessment.

### *Recognize Food Groups*

Just over half of the children (*n* = 93; 56.4%) exhibited an increase in assessments which evaluated a child's ability to recognize food from each of the five food groups. After pre- and post-test calculations, 57 students (34.5%) did not have a change. Less than 10% of students (*n* = 15) had a negative change from pre- to post-scores.

### *Healthy Plate*

The majority of students (*n* = 127; 76%) showed improvements on creating a healthy plate assessment after participation in the program. Following participation in the curriculum program, 23 (13.8%) children did not show knowledge change. In regard to the Healthy Plate assessment, 17 students (10.2%) performed worse on the Healthy Plate post-assessment than on the pre-evaluation.

### *Food Origins*

The majority of children (*n* = 92; 55.9%) increased their ability to determine where food comes from following their participation in the *WannaBee Healthy?* program.

Over 30% (*n* = 51) of children did not show any knowledge change on this assessment, whereas 22 (13.3%) children's evaluations reflected a negative change.

### *Increased Heart Rate*

While choosing activities that increased heart rate, 61 students or 37% showed improvement between pre- and post-evaluations. The scores of 88 students (53.3%) did not differ between their pre- and post-assessments. A reduction in knowledge was found for 16 (9.7%) students.

### *Healthy Behavior*

In regard to children's ability to select healthy behaviors, 65 students (39.3%) showed improvement. A majority of students (*n* = 88; 53.3%) showed no change in knowledge of healthy behaviors following their participation in the *WannaBee Healthy?* program. A small percentage (*n* = 12; 7.3%) showed a decreased ability to select healthy behaviors after participation.

## Dosage and Type of Implementation

A series of one-way ANOVAs was conducted to evaluate the null hypothesis that there was no difference in the five child health knowledge change scores based on the dosage of the curriculum in its entirety (i.e., total curriculum activities implemented), or by dosage within a domain (i.e., books, creative expressions, literacy/language, math, science), or by dosage within theme (i.e., nutrition, physical activity). For example, an ANOVA was conducted to examine if the total number of activities implemented by the teacher during the month (dosage) was associated with children's change in knowledge on the five outcomes measures (i.e., food groups, physical activity, food origins, healthy behaviors, MyPlate). Results are reported below by dosage variable.

### ***Overall Curriculum Dosage***

Results of the ANOVA indicated no significant differences by implementation. That is, children's knowledge change following participation in the *WannaBee Healthy?* program did not significantly differ based on how the number of activities from the curriculum their teacher implemented. Overall curriculum dosage was not related to knowledge change.

### ***Books Dosage***

Results of the ANOVA indicated one significant result. That is, results indicated that the number of books implemented over the intervention period was significantly related to children's ability to accurately identify physically active behaviors [$F(5,158) = 3.270$, $p = 0.008$]. Post hoc comparisons to evaluate pairwise differences among group means were conducted with the use of the Tukey HSD test. Tests revealed significant pairwise differences between the mean change scores of students who had four books read to them ($M = -1.0$, $SD = 1.73$) and students who had seven ($M = 2$, $SD = 1.00$, $p = .005$) books read, with students who had seven books read to them showing higher gains in knowledge than their counterparts who had four books read.

### ***Creative Expressions Dosage***

ANOVA results indicated significant differences in children's ability to correctly identify a MyPlate healthy plate based on the number of creative activities implemented by the teacher [$F(9,156) = 3.283$, $p = 0.001$]. A Tukey post hoc test indicated significant differences between implementation of six (*M* = 0.43, *SD* = 1.72) and nine (*M* = 2.44, *SD* = 1.50, $p < .00$) creative expression lessons, with children who experienced nine of the creative expression activities performing better than the children who engaged in six of the creative expression activities. Also, significant differences were identified by Tukey post hoc between seven (*M* = 0.000, *SD* = 1.41) and nine (*M* = 2.44, *SD* = 1.50, $p<.05$) creative lessons implemented during the intervention period. That is, children in classrooms with teachers who implemented nine creative expression activities performed significantly better than children who were from classrooms where only seven creative expression activities were implemented. None of the other four child assessments significantly differed by the amount of creative expression activities implemented.

### *Language & Literacy Dosage*

The results from the ANOVA indicated no significant differences on any of the outcomes. Thus, the null hypothesis was accepted. The variation in language and literacy activities the children were exposed to from the curriculum did not relate to the five knowledge change scores.

### *Math Dosage*

ANOVA results showed significant differences in children's ability to correctly identify a MyPlate healthy plate based on the number of math activities their teacher implemented [$F(7,159) = 2.998$, $p = 0.008$]. Post hoc comparisons using the Tukey HSD test indicated that children's change scores on the MyPlate healthy plate assessment significantly differed when children participated in seven (*M* = 0.62, *SD* = 2.02) math activities in comparison to when they engaged in nine (*M* = 2.80, *SD* = 1.48, $p = .03$)

math lessons. That is, children showed significantly higher knowledge change in creating a healthy MyPlate when teachers had implemented nine math lessons in their classroom, compared to teachers that implemented seven math lessons in their classroom. The other four child outcome change scores did not differ based on the math dosage variable.

### ***Science Dosage***

The results of the one-way ANOVA revealed significant differences for one of the five child outcomes as it related to the implementation of science activities. That is, there was a significant group difference in children's ability to correctly identify physically active behaviors based on the science activity implementation [$F(10,160) = 2.394$, $p = 0.012$]. The results of the Tukey post hoc test indicated significant differences in children's ability to identify activities that increase heartrate change scores when teachers implemented two ($M = -1.0$, $SD = 1.73$) science lessons in comparison to five ($M = 1.07$, $SD = 1.14$, $p = .051$) science lessons. None of the other four child assessments significantly differed by the amount of science lessons implemented in by teachers.

### ***Nutrition Dosage***

ANOVA findings indicted that two of the five child evaluations significantly differed by groupings based on the dosage of nutrition-based activities. Specifically, the ability for children to correctly identify physically active behaviors [$F(15,164) = 1.770$, $p = 0.044$] and their ability to correctly identify a MyPlate healthy plate [$F(15,166) = 1.778$, $p = 0.043$] differed by the nutrition implementation group. Post hoc analysis revealed significant differences in identifying activities that increase heartrate change scores between implementing 10 ($M = -1.0$, $SD = 1.73$) nutrition lessons and 25 ($M =$

2.00, *SD* = 1.0, *p* = .029) nutrition lessons. That is, children showed significantly higher knowledge change in identifying activities that increase heartrate when teachers had implemented 25 nutrition lessons than when they implemented 10 nutrition lessons. Additionally, a significant difference existed in child knowledge change of the MyPlate healthy plate assessment when the teacher implemented 32 nutrition activities in the classroom (*M* = 0.40, *SD* = 1.84) in comparison to implementing 42 nutrition-based lessons *(M* = 2.47, *SD* = 1.59, *p* = .047). Thus, children who engaged in 42 nutrition-based lessons performed significantly better on the MyPlate healthy plate assessment than their counterparts who participated in 32 of those lessons.

### *Physical Activity*

Results of the ANOVA conducted based on the grouping by number of activities associated with physical activity indicated one significant result. That is, group differences were found on children's ability to correctly identify a MyPlate healthy plate based on how many activities teachers implemented within the classroom that involved physical activity lessons [F(8,166) = 2.211, *p* = 0.029]. Post hoc comparisons using the Tukey HSD test indicated a significant difference between 9 (*M* = 0.71, *SD* = 1.38) and 11 *(M* = 3.0, *SD* = 1.0, *p* = .067) lessons implemented. That is, students who were in classrooms where the teacher implemented 11 physical activity-related lessons showed significantly increased growth on the MyPlate assessment in comparison to those children who only participated in 9 physical activity lessons.

A Multivariate Analysis of Covariance (MANCOVA) was performed to establish whether the change scores on the five child assessments (i.e., food groups, physical activities, food origins, healthy behaviors, and MyPlate healthy plate) differed based on the dosage of the curriculum to which the children were exposed, controlling for the time between the pre- and post-assessments. Based on information from the four teacher implementation groups, results indicated no statistically significant difference between the total number of activities implemented and any of the five child assessment change scores after controlling for time.

## Discussion

The original evaluation of the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science program, which included multiple components including an integrated curriculum, a field trip, and a family workbook, was shown to be effective in improving children's health knowledge (Cross et al., 2017). The objective of this study was to take that evaluation one-step further by determining if teachers' choice in dosage and type of activity implementation of an integrated health science curriculum for pre-kindergarten and kindergarten classrooms was driving that positive change in children's healthy behavior knowledge. Findings suggest that the effectiveness of the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science program was a result of a combination of program components, not just the implementation of the integrated curriculum. These findings align with this study's guiding theory based on Urie Bronfenbrenner's Ecological Theory of Human Development (1974), which identifies the importance of both environment and experiences on development of the whole child. That is, a child's interactions that transpire throughout the day and situations they encounter within their immediate environments (e.g., home, peer groups, church, classrooms) influence growth and development. The importance of the school to home connection (mesosystem) and the child to community connection (exosystem) comes to light since changes in child knowledge were not just based on curriculum alone. Therefore, the effectiveness of the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* program was likely grounded in an interrelated effect, whereas dosage and type of lessons implemented in the classroom were just one component driving student learning. It is possible that discussions taking place at home surrounding the parent activity workbook supported classroom discussions and/or the health fieldtrip experience offered additional elements of the program to help promote positive changes in children's health behavior understanding.

At least one child outcome significantly differed according to implementation of all individual domains and themes except for the language and literacy domain. It is unclear why language and literacy were not predictive, however, it is important to note that the curriculum considered books (a component of literacy) to be a separate domain and there was a difference by the number of books read on the children's ability to select photos of children engaging in physical activity. The inclusion of more nutrition activities was the best predictor of knowledge change (i.e., 2 of 5 outcomes were significant), which was not surprising given the focus on nutrition in the curriculum.

The outcomes that showed the most variability in change by curriculum implementation were children's ability to identify a MyPlate healthy plate and photos of children engaging in physical activity. Given the amount of nutrition activities included in the curriculum, these findings support the idea that repetitive exposure to information (i.e., nutrition instruction) enhances child retention and leads to skill mastery (i.e., performance on child assessments) (French, 2004; Perera et al., 2015; Tippett & Milford, 2017). Results could also be attributed to the United States Department of Agriculture's

(USDA) 2011 redesign of the MyPyramid diagram into a more recognizable place setting visual (USDA; Center for Nutrition Policy and Promotion, 2017). The five food groups are represented on the newer format to encourage healthier food and drink selections, and since the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* curriculum contained lessons that included the MyPlate visual, the redesign may be successful. Additionally, teachers could have implemented the physical activities as a means to allow students to "get their wiggles out" without requiring much time out of their daily routine. Students engaging in activities with movement or exercise could account for students' ability to select physical activities. None of the curriculum implementation variables were predictive of children's ability to correctly identify food groups, food origins, or all three healthy behaviors for one's body. This finding could have been related to the types of activities that the curriculum included to address these areas. For example, the curriculum provided a variety of hands-on, interactive lessons, and although books and materials were provided to the teachers, some planning and preparation were still needed. Many of those hands-on, engaging lessons also require more time to implement, depending on the nature of the activity (e.g., placing students into cooperative groups, distributing and collecting materials, providing instructions). It is possible that teachers chose to utilize lessons that did not require as much time to prepare or that would not take as much time out of their scheduled routines, therefore possibly forgoing the implementation of interactive lessons. If children were not exposed to engaging, hands-on activities known to support learning (French, 2004; NAEYC, 2017), it is possible they did not retain information required to perform well on the tasks included in the child assessments.

## Limitations

The teacher usage checklist is considered a limitation in the present study. Given that the checklist was a crucial component of the examination of the curriculum, the large number of blank responses received by researchers is troubling. The layout is also of concern, as it did not provide a place for teachers to document which implementation timetable they used: two-week or four-week period. Also worth mentioning is the inability for teachers to denote why they circled a “Y-.” That is, what was included (or not included) in the lessons that led them to determine they would not use it again? Researchers could gain valuable information in regard to creating engaging lessons that teachers would implement into their instructional day through written comments or knowing how long teachers spent on the curriculum, but only if teachers take the time to complete the checklist and disseminate that information to researchers via surveys.

Timing of events and implementation also have limitations. For instance, scheduled timing of the HealthWorks! North Mississippi fieldtrip could have impacted the findings of the original evaluation of the *WannaBee Healthy?* program if some students had more exposure to the curriculum before engaging in the fieldtrip’s follow-up, related activities, than other students. Additionally, teachers had the opportunity to complete the two-week guided lesson plan within the span of a month, but were not allowed to decide which 30-day period. This poses a dilemma for teachers if the time of implementation is during a point in the semester already considered challenging due to strains on instruction time (e.g., holiday parties or days off, screening/testing dates, inclimate weather concerns). The amount of activities implemented may have risen if teachers had been able to decide when and for how long they utilized the curriculum in their classrooms, possibly increasing the reported effectiveness of the health science program.

Another limitation of the current study was the inequality of themes (i.e., nutrition, physical activity) interwoven into the curriculum. For example, more than three times the amount of activities focused on nutrition than physical activity, and so few activities focused on sleep that it was not able to be assessed. In order for the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* curriculum to support the goal to increase child knowledge in both of the health-related themes, the curriculum should attempt to balance the amount of activities throughout the instructional plan. By expanding the presence of physical activities in the curriculum, lessons could encourage greater levels of learning across the content and would offer teachers a larger variety of options to implement in their classrooms.

There are also limitations linked with child assessments. The sample of children participating in the pre- and post-assessments were randomized among participating classrooms and may not be representative of all students. Children who were absent on assessment days were not assessed, possibly providing data more generalized to students likely to not have absences during the school year.

**Future Directions**

Evidence presented in this study reiterates the importance of program fidelity. That is, developers can create curriculum based on sound theoretical practices and rich, engaging lessons, but if teachers do not fully execute the program, the effectiveness of the program diminishes. Therefore, it is recommended that researchers further the *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* program by extending training opportunities to include a more comprehensive approach. For instance, participants could attend an introductory professional development workshop on how to incorporate the lessons into daily routines along with demonstrations of how to successfully utilize the toolkit of materials and complete the usage checklist. Monthly follow-up cohort meetings could be facilitated to offer practice implementing lessons and technical support to teachers, as well as provide opportunities for participants to converse with colleagues and share experiences. Researchers could use cohort meetings as a time to ask participating teachers for input on lesson successes and failures, using gained information to guide revision of activities to accommodate teachers in the field.

Revision of the curriculum is advised to include balancing the amount of activities within each theme. Students should have the opportunity for equal exposure to nutrition, physical activity, and sleep. A comment line should also be inserted into the usage checklist, where teachers could transcribe notes on why they chose not to implement a particular lesson or why they would not use it again. In addition, teachers should be given control of implementation dates to accommodate their school calendar. With participants having the freedom of selecting the date and length of implementation into their classroom schedule, teachers may implement a larger number of activities, offering a more accurate analysis of the curriculum impact on child behavior knowledge.

## Summary

The *WannaBee Healthy? Be Smart! Be Active! Be a Leader!* health science curriculum is an inventive, integrated approach to encouraging the development of positive health habits among students in an early childhood program. Findings of the present study are promising with regards to the capability of addressing underlying characteristics that lead to obesity (e.g., poor diet choices and sedentary activity) and promoting behaviors to increase student wellbeing. By examining teacher implementation as it relates to changes in child health knowledge, this study contributes new evidence that will assist educators, curriculum developers, and advocates of child health to alter poor health trajectories among young students.

# REFERENCES


Bronfenbrenner, U. (1974). Developmental Research, Public Policy, and the Ecology of Childhood. Child Development, *45*(1), 1-5.

Chung, M., & Keckler, B. (2016). Shared-book experience using science-themed books to develop scientific literacy: An interactive approach with struggling readers. *The Language and Literacy Spectrum*, *26*, 31-40.

Common Core Standards Initiatives. (2016). *Read the Standards*. Retrieved June, 2018 from http://www.corestandards.org/ELA-Literacy/

Cross, G., Parker, J., Long, L., Gallman, S., Loden, D., & Hanna, H. (2017). SEPA Final Report. Unpublished evaluation.

Dudley, D., Cotton, W., & Peralta, L. (2015). Teaching approaches and strategies that promote healthy eating in primary school children: A systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, *12*, 28.

Eshach, H., & Fried, M. (2005). Should science be taught in early childhood? *Journal of Science Education and Technolog*y, *14*, 315-336.

Evangelou, D. (2010). Child development perspective in engineering education: Why STEM now? *Early Childhood Research and Practice*, *12*(2).

Finkelstein, E., Trogdon, J., Cohen, J., & Dietz, W. (2009). Annual medical spending attributable to obesity: Payer- and service-specific estimates. *Health Affairs*, *25*(5), w822-w831.

French, L. (2004). Science as the center of a coherent, integrated early childhood curriculum. *Early Childhood Research Quarterly*, *19*, 138-149.

Gardner, H. (1993). Multiple Intelligences. The Theory in Practice. New York: Basic Books.

Gerde, H., Schachter, B., & Wasik, B. (2013). Using the scientific method to guide learning: An integrated approach to early childhood curriculum. *Early Childhood Education Journal 41*, 315-323.

Gerde, H., Pierce, S., Lee, K., et al. (2018). Early childhood educators' self-efficacy in science, math, and literacy instruction and science practice in the classroom. *Early Education and Development*, 1-21.

Haury, D.I. (2001). Teaching science through inquiry with archived data. Columbus, OH: ERIC Clearinghouse for Science Mathematics and Environmental Education. (ED465545)

Horizon Research. (2013). Report of the 2012 national survey of science and mathematics education. Chapel Hill, NC: NSSME.

Kitahara, C., Flint, A., Berrington de Gonzalez, A., et al. (2014). Association between class III obesity (BMI of 40-59 kg/m) and mortality: A pooled analysis of 20 prospective studies. *PLoS Medicine*, doi:10.1371/journal.pmed.1001673

Lee, C., & Shea, M. (2016). An analysis of pre-service elementary teachers' understanding of inquiry-based teaching. *Science Education International*, *27*(2), 217-237.

Lo, K., Cheung, C., Lee, A., Tam, W., & Keung, V. (2015) Associations between parental feeding styles and childhood eating habits: A survey of Hong Kong pre-school children. *PLoS ONE*, 10(4):e0124753.doi10.1371/journal.opone.0124753

McLean, K., Jones, M., & Schaper, C. (2015). Children's literature as an invitation to science inquiry in early childhood education. *Australasian Journal of Early Childhood*, *40*(4), 49-56.

Mississippi State Department of Health. Mississippi Behavioral Risk Factor Surveillance System. Retrieved September, 2017 from http://msdh.ms.gov/brfss/

National Association for the Education of Young Children. (2013). NAEYC Early Childhood Program Standards and Accreditation Criteria & Guidance for Assessment, Retrieved August, 2018 from htpp://www.naeyc.org/files/academy/file/AllCriteriaDocument.pdf

National Association for the Education of Young Children. (2017). *The Case of Brain Science and Guided Play: A Developing Story*, Retrieved June, 2018 from htpp://www.naeyc.org/resources/pubs/yc/may2017/case-brain-science-guided-play

National Research Council. (2011). *Successful K-12 STEM education: Identifying effective approaches in science, technology, engineering and mathematics.* Washington, DC: The National Academies Press.

National Science Teachers Association. (2014). *Statement of Early Childhood Science Education*, Retrieved June, 2018 from http://www.nsta.org/about/positions/earlychildhood.aspx

Next Generation Science Standards Lead States (2013). *Next generation science standards: For states, by states*. Washington, DC: National Academies Press.

Nicklaus, S., & Remy, E. (2013). Early origins of overeating: Tracking between early food habits and later eating patterns. *Current Obesity Reports, 2,* 179-184. doi10.1007/sI3679-013-0055-x

Ogden, C., Carroll, M., Kit, B., & Flegan, K. (2014). Prevalence of childhood and adult obesity in the United States, 2011-2012. *Journal of American Medical Association*, *311*, 806-814.

Pendergast, E., Lieberman-Betz, R., & Vail, C. (2017). Attitudes and beliefs of prekindergarten teachers toward teaching science to young children. *Early Childhood Education Journal*, *45*(1), 43-52. doi:10.1007/s10643-015-0761-y

Perera, T., Frei, S., Frei, B., Wong, S., & Bobe, G. (2015). Improving nutrition education in U.S. elementary schools: Challenges and opportunities. *Journal of Education and Practice*, *6*(30), 41-50.

Pinkoski-Ball, C., Reighle, J., & Munson, B. (2012). Synthesized speech intelligibility and early preschool-age Children: Comparing accuracy for single-word repetition with repeated exposure. *American Journal of Speech-Language Pathology*, *21*(4), 293-301. doi:10.1044/1058-0360(2012/11-0020)

Plourde, L. (2002). The influence of student teaching on pre-service elementary teachers' science self-efficacy and outcome expectancy beliefs. *Journal of Instructional Psychology, 29*(4), 245-252.

Puhl, R., & Luedicke, J. (2012). Weight-based victimization among adolescents in the school setting: Emotional reactions and coping behaviors. *Journal of Youth Adolescence*, *41*(1), 27-40. doi:10.1007/s10964-011-9713-z.

Songer, N., Lee, H., & Kam, R. (2002). Technology-rich inquiry science in urban classrooms: What are the barriers to inquiry pedagogy? *Journal of Research in Science Teaching*, *39*(2), 128-150.

Sun, H., Chen, A., Zhu, X., & Ennis, C. (2012). Learning science-based fitness knowledge in constructivist physical education. *The Elementary School Journal*, *113*(2), 215-229. http://doi.org/10.1086/667405

Tippett, C. D., & Milford, T. M. (2017). Findings from a pre-kindergarten classroom: Making the case for STEM in early childhood education. *International Journal of Science and Math Education, 15*(1), S67-S86.

Trust for America's Health & Robert Wood Johnson Foundation. (2013). F as in fat: How obesity threatens America's future. Retrieved September, 2017 from http://stateofobesity.org/files/fasinfat2013.df

Trust for America's Health & Robert Wood Johnson Foundation. (2016). The state of obesity in Mississippi. Retrieved September, 2017 from http://stateofobesity.org

Tu, T. (2006). Preschool science environment: What is available in a preschool classroom? *Early Childhood Education Journal*, *33*, 245-251.

United States Department of Agriculture. (2017). Center for Nutrition Policy and Promotion: MyPlate/MiPlato. Retrieved February, 2018 from https://www.cnpp.usda.gov/MyPlate

United States Department of Agriculture. (2017). School meals: Healthy Hunger-Free Kids Act. Retrieved February, 2018 from https://www.fns.usda.gov/school-meals/healthy-hunger-free-kids-act

Uyanik, G. (2016). Investigation of the self-efficacy beliefs in teaching science and attitudes towards teaching profession of the candidate teachers. *Universal Journal of Educational Research, 4*(9), 2119-2125. doi:10.13189/ujer.2016.040924

Wang, Y., McPherson, K., Marsh, T., Gortmaker, S., & Brown, M. (2011). Healthy and economic burden of the projected obesity trends in the USA and the UK. *Lancet*, *378*, 815-825.

Wilson-Lopez, A., & Gregory, S. (2015). Integrating literacy and engineering instruction for young readers. *Reading Teacher*, *1*(25).

Wright, T., & Gotwals, A. (2017). Supporting kindergarteners' science talk in the context of an integrated science and disciplinary literacy curriculum. *The Elementary School Journal*, *117*(3). Retrieved October, 2017 from http://www.journals.unchicago.edu/t-and-c

Yildiz-Duban, N., & Gokcakan, N. (2012). Classroom teacher candidates' attitudes towards teaching profession and self-efficacy towards science teaching. *Institute of Social Science Journal*, *21*(1), 267-280.

Zhai, J., & Tan, A. (2015). Roles of teachers in orchestrating learning in elementary science classrooms. *Research Science Education*, (45)907-926. doi:10.1007/s11165-014-9451-9

# APPENDIX A

## CURRICULUM USAGE CHECKLIST

# Curriculum Usage

**Instructions**
For each activity in the matrix, please indicate the following. Circle the indicator that best describes your usage of each activity.

**Y+** If you implemented this activity and plan to use it again
**Y-** If you implemented this activity but do NOT plan to use it again
**N** If you did NOT implement this activity

| WannaBee Healthy Curriculum | | | | | |
|---|---|---|---|---|---|
| | Week 1 | | | | |
| | Monday | Tuesday | Wednesday | Thursday | Friday |
| Books | Read: *WannaBee Healthy!: Be Smart, Be Active, Be a Leader!* page 13<br>Y+ Y- N | Read: *Up, Down, and Around* page 20<br>Y+ Y- N | Read: *The Little Mouse, the Red Ripe Strawberry, and the Big Hungry Bear* page 25<br>Y+ Y- N | Read: *Healthy Eating with MyPlate: Dairy* page 31<br>Y+ Y- N | Read: *I Eat a Rainbow* page 37<br>Y+ Y- N |
| Creative Expression | Read: *Healthy Eating with MyPlate Using My-Plate* page 14<br>Y+ Y- N | Activity: Tutti-Frutti Play Dough! page 21<br>Y+ Y- N | Activity: Strawberry Art page 26<br>Y+ Y- N | Activity: "Dem Bones" page 32<br>Y+ Y- N | Activity: Red, Yellow, Green…What Do They Mean? Eat a Rainbow! page 38<br>Y+ Y- N |
| Language & Literacy | Activity: "If You're Healthy and You Know It" page 15<br>Y+ Y- N | Activity: Flannel Board Fun page 22<br>Y+ Y- N | Activity: Way Up High page 27<br>Y+ Y- N | Activity: Word Box Food Groups page 34<br>Y+ Y- N | Activity: I Went to the Store page 39<br>Y+ Y- N |
| Math | Activity: Be Smart Chart! page 17<br>Y+ Y- N | Activity: Match-Up Math page 23<br>Y+ Y- N | Activity: Fruity Math page 29<br>Y+ Y- N | Activity: Fruit and Veggie Patterns page 35<br>Y+ Y- N | Activity: Fruit and Veggie Sort page 40<br>Y+ Y- N |
| Science | Activity: MyPlate Fun! page 19<br>Y+ Y- N | Activity: Be Smart Memory page 24<br>Y+ Y- N | Activity: How Much Sugar is in My Drink? page 30<br>Y+ Y- N | Activity: My Healthy Foods Book page 36<br>Y+ Y- N | Activity: Be Smart - Making Predictions page 41<br>Y+ Y- N |

## Curriculum Usage:

**Instructions:**

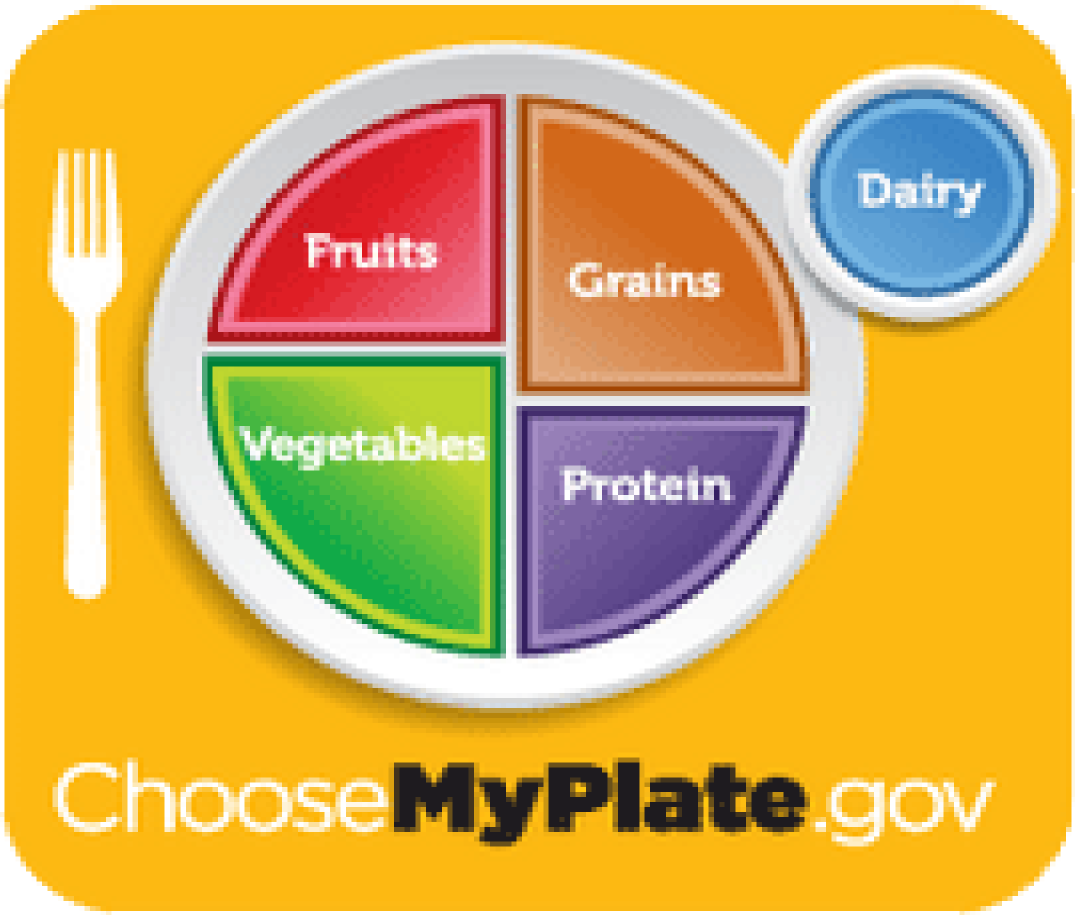
For each activity in the matrix, please indicate the following. **Circle the indicator that best describes your usage of each activity.**

- Y+ If you implemented this activity and plan to use it again
- Y- If you implemented this activity but do NOT plan to use it again
- N If you did NOT implement this activity

| WannaBee Healthy Curriculum — Week 2 | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Books | Read: *Healthy Eating with MyPlate: Vegetables* page 43 Y+ Y- N | Read: *Healthy Eating with MyPlate: Fruits* page 50 Y+ Y- N | Read: *Healthy Eating with MyPlate: Protein* page 56 Y+ Y- N | Read: *From Head to Toe* page 63 Y+ Y- N | Read: *The Napping House* page 68 Y+ Y- N |
| Creative Expression | Activity: I SEE, You SEE page 44 Y+ Y- N | Activity: How Does Food Help Make Me Strong? page 51 Y+ Y- N | Activity: "Head, Shoulders, Knees, and Toes" page 57 Y+ Y- N | Activity: LaToya Says Move Together! page 64 Y+ Y- N | Activity: Bodies Need Sleep - "Andy Active Hammers" page 69 Y+ Y- N |
| Language & Literacy | Activity: *Healthy Eating with MyPlate: Vegetables* page 46 Y+ Y- N | Activity: Healthy Food Word Box page 55 Y+ Y- N | Activity: *Healthy Eating with MyPlate Grains* page 59 Y+ Y- N | Activity: Read & Move - I Can Do It! page 65 Y+ Y- N | Activity: *The Napping House* or *Goodnight Moon* page 72 Y+ Y- N |
| Math | Activity: Tracking My Exercise! page 47 Y+ Y- N | Activity: Healthy or Unhealthy? A Sorting Game! page 54 Y+ Y- N | Activity: Yum, Yum. What Fun! page 60 Y+ Y- N | Activity: Be Smart Math Game page 66 Y+ Y- N | Activity: An Apple a Day! page 74 Y+ Y- N |
| Science | Activity: Be Smart...Bean Smart: Growing and Learning page 49 Y+ Y- N | Activity: Be Smart Food Choices! page 55 Y+ Y- N | Activity: Juicy, Juicy, Yum! page 61 Y+ Y- N | Activity: Be Smart, Be Active: Calories Count page 67 Y+ Y- N | Activity: Putting it All Together page 75 Y+ Y- N |

APPENDIX B

USDA MYPLATE


Fruits
Grains
Dairy
Vegetables
Protein
ChooseMyPlate.gov

# APPENDIX C

# CHILD ASSESSMENT SCRIPTS

**Child Assessment Scoring Sheet:**

Code #: ____________________
Date: ____________________
Assessor: ____________________
Scorer: ____________________

Age: __________
Gender: __________
Race: ________________________

**FOOD GROUP CLASSIFICATION:**

Procedure:

- *Use a box or other container with 10 food and/or drink models inside, 2 models from each food group [e.g., chicken, egg, milk, cheese, orange, banana, carrot, broccoli, bread, crackers; Note: others may be substituted based on availability of food models]*
  *The foods will presented in one of two orders inside the container (with pictures on the bottom to assist the assessment team with orders)*
- *Use an empty shopping bag or basket*

Instructions:

Say to the children,

*"Pretend that you are at the market and want to buy foods from all 5 food groups.*
*The market has [naming each food model as you pick them up out of the box or container].*

- *Can you pick a FRUIT and put it in your shopping bag/basket (pointing to the shopping bag/basket)?*
- *Can you pick a VEGETABLE and put it in your bag/basket (pointing to the shopping bag/basket)?*
- *Can you pick a GRAIN?*
- *Can you pick a PROTEIN?*
- *Can you pick a DAIRY?*

| Item they picked: | Food Groups | | | | |
|---|---|---|---|---|---|
| | FRUIT | VEGETABLE | GRAIN | PROTEIN | DAIRY |
| Banana | | | | | |
| Bread | | | | | |
| Broccoli | | | | | |
| Carrot | | | | | |
| Cheese | | | | | |
| Chicken | | | | | |
| Crackers | | | | | |
| Egg | | | | | |
| Milk | | | | | |
| Orange | | | | | |

*Source:* *Developed by project team*
*Scoring:* % of children who pick representative for each food group (# of 5)

**MYPLATE RECOMMENDATIONS / FOOD GROUP CLASSIFICATION:**

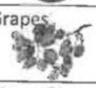
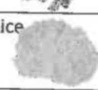
Procedure:

*Use a plastic MyPlate with food groups labeled & 10 printed food cards with 2 food items from each food group. The food group cards [e.g., Chicken leg, eggs, broccoli, carrots, apple, grapes, rice, bread, milk, & cheese] will be presented in one of two orders (with numbers on the back of each card to assist the assessment team with the orders).*

Instructions:

***Say to the children, "Look at all of the pictures** [gesture toward pictures]. **[Go through EACH picture, telling the child "This is a picture of [item names]." Now, look at the MyPlate plate. It has sections for all 5 food groups. Pick ONE food or drink picture for each food group** [Point to each section on the plate] **and place it in its food group section on the plate to make a healthy plate.***

Responses:

| **Items they picked:** | **Where they put the item on the plate:** | | | | |
|---|---|---|---|---|---|
| | Fruits | Vegetables | Grains | Protein | Dairy |
| Chicken Leg  | | | | | |
| Eggs  | | | | | |
| Broccoli  | | | | | |
| Carrots  | | | | | |
| Apple  | | | | | |
| Grapes  | | | | | |
| Rice  | | | | | |
| Bread  | | | | | |
| Milk  | | | | | |
| Cheese  | | | | | |

Researchers' Notes: ______________________________

*Source:* *Developed by project team*

*Scoring:* % of children who can create a plate with all 5 food groups (based on MyPlate)

**FOOD ORIGIN:**

Procedures:
Food origin pictures will be presented all at one time, in random order, on a single sheet of paper on a table [e.g., cow, chicken, garden, tree, wheat, grocery store, restaurant].

Food/beverage pictures will be held by the assessment team and presented, one at a time, in one of two orders [e.g., milk, carrot, wheat bread, apple, and grilled chicken leg]

Instructions:
*Point to each food origin picture on the single sheet of paper and tell children, "This is ________"*

*Holding up each food/beverage picture say to the children, "This is ________"*
*"Put this picture of [name of food/drink] on top of the picture that shows where it comes from." Have them physically put the picture on top of the origin. Once finished with each one, pick up the food picture and put it to the back of the stack. Move to the next food picture. This way, children know they can choose the food origin more than one time.*

Responses (draw a line from the food to the food origin chosen)

| | |
|---|---|
| Apple | Tree |
| Carrot | Garden |
| Chicken leg | Chicken |
| Milk | Cow |
| Bread | Wheat |
| | Grocery store |
| | Restaurant |

*Source:* *Developed by project team*
*Scoring: Child:* % of children who can match foods with their origin

ACTIVITIES THAT INCREASE HEART RATE:

Procedure:
Lay out pictures of children doing 10 different activities, in one of two orders (see pictures below)

Instructions:
Say to the children, "There are 10 pictures of children doing different activities. [Going through each one, say "In this picture, the children are [activity name]."

Say to the children, **"From these pictures, choose 4 activities that make your heart beat faster. You can hand them to me** [have them hand to you and line them up. Prompt them to continue picking until they have 4]."

Responses (write the #s 1-4 to indicate the order they chose their 4 choices):

1. Playing a video game ____________
2. Jumping rope ____________
3. Riding a bike ____________
4. Watching TV ____________
5. Playing on a computer ____________
6. Running ____________
7. Playing soccer ____________
8. Playing with toys ____________
9. Playing on a playground ____________
10. Drawing ____________

Researchers' Notes: ____________________________________

____________________________________

*Source:* *Adapted from Mobley & Evashevski (2000)*
*Scoring: Child:* % of children who identify "more active" activities as those that make their heart beat faster

**HEALTHY BODY NEEDS:**

Procedure:

*Use 7 pictures of behaviors, sorted in one of two orders on the table. For example:*

- *Picture of child sleeping*
- *Picture of child eating a healthy plate*
- *Picture of child playing soccer*
- *Picture of child watching tv*
- *Picture of child drinking soda*
- *Picture of child eating a candy bar*
- *Picture of child playing a video game*

Instructions:

Say to the children,

"Look at all of the pictures [gesture toward pictures]. "This is a picture of a child [name activities here]. Pick one picture that shows one important thing we need to do to keep our body healthy and hand it to me [response]. Can you find another picture that shows something we need to do to keep our body healthy and hand it to me [response]? Can you find one more picture that shows something we need to do to keep our body healthy [response]?[ Line the cards up as the children hand them to you].

Responses (write in the # indicating order of choices – 1, 2, and 3):

____ *Sleeping*
____ *Eating a healthy plate*
____ *Playing soccer*
____ *Watching tv*
____ *Drinking soda*
____ *Eating a candy bar*
____ *Playing a video game*

Researchers' Notes: ______________________________________________
______________________________________________

*Source:* *Developed by project team*
*Scoring:* *Child: % correct the 3 healthy body needs; Item: % of children saying each is one of the healthy body needs*

Table 1 Teacher Implementation

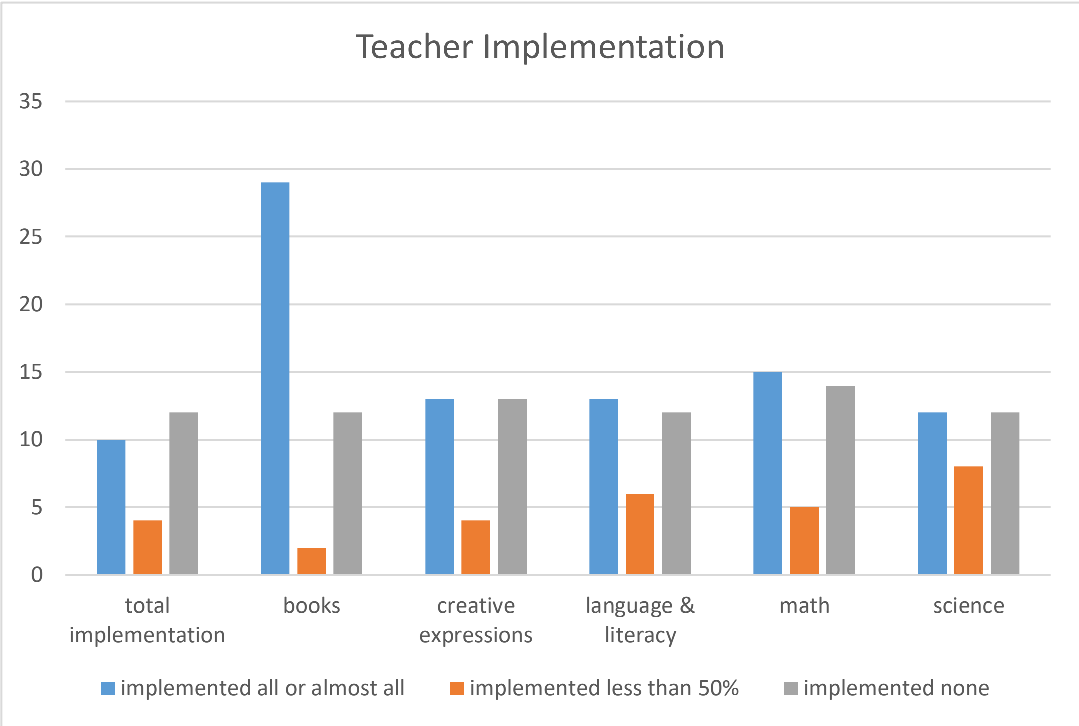


Table 2 Teacher Implementation: Theme

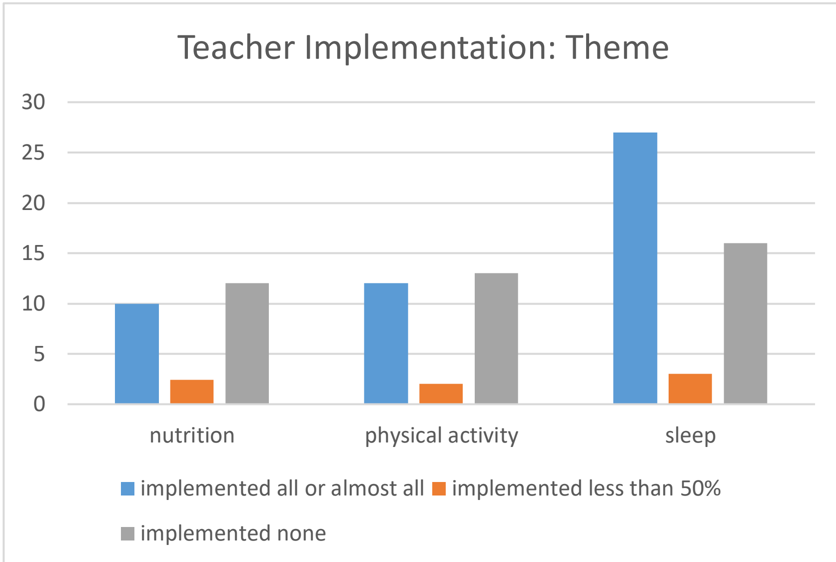


Table 3 Teacher Implementation Groups

Table 3

Teacher Implementation Groups

| | Teachers |
|---|---|
| Group 1 – implemented all curriculum activities, % | 12.6 |
| Group 2 – implemented from 1 to 36 curriculum activities, % | 28.7 |
| Group 3 – implemented from 37 to 49 curriculum activities, % | 35.9 |
| Group 4 – implemented none of the curriculum activities, % | 22.8 |

Differences in Child Knowledge (Change Scores)

| | **5.0** | **4.0** | **3.0** | **2.0** | **1.0** | **0** | **-1.0** | **-2.0** | **-3.0** | ***Mdn*** |
|---|---|---|---|---|---|---|---|---|---|---|
| Student Assessments | | | | | | | | | | |
| *Test 1 - Food Group Classification | | | | | | | | | | |
| Frequency | | | | 27 | 66 | 57 | 13 | 2 | | 1.0 |
| Valid Percent | | | | 16.4 | 40.0 | 34.5 | 7.9 | 1.2 | | |
| *Test 2 - MyPlate Recommendations | | | | | | | | | | |
| Frequency | 6 | 16 | 30 | 44 | 31 | 23 | 10 | 6 | 1 | 2.0 |
| Valid Percent | 3.6 | 9.6 | 18.0 | 26.2 | 18.6 | 13.8 | 6.0 | 3.6 | 0.6 | |
| *Test 3 - Food Origin | | | | | | | | | | |
| Frequency | | 9 | 10 | 26 | 47 | 51 | 16 | 5 | 1 | 1.0 |
| Valid Percent | | 5.5 | 6.1 | 15.7 | 28.5 | 30.9 | 9.7 | 3.0 | 0.6 | |
| Test 4 - Recognition of Activities that Increase Heart Rate | | | | | | | | | | |
| Frequency | | | 11 | 12 | 38 | 88 | 14 | 1 | 1 | 0.0 |
| Valid Percent | | | 6.7 | 7.3 | 23.0 | 53.3 | 8.5 | 0.6 | 0.6 | |
| Test 5 - Recognition of Healthy Body Needs | | | | | | | | | | |
| Frequency | | | | 8 | 57 | 88 | 11 | 1 | | 0.0 |
| Valid Percent | | | | 4.8 | 34.6 | 53.3 | 6.7 | 0.6 | | |

*50% or more of students showed improvement from pre- to post-test

Table 4 Participant Demographics

Table 4

*Participant Demographics*

| | Children | Teachers |
|---|---|---|
| *n* | 252 | 57 |
| Age | | |
| *M (SD)* | 5.02 (0.58) | 35.5 (9.3) |
| Grade | | |
| Pre-K, % | 17.9 | |
| Kindergarten, % | 82.1 | |
| Gender | | |
| Female, % | 48.4 | 98.2 |
| Male, % | 51.2 | 0.0 |
| Ethnicity | | |
| Hispanic or Latino, % | 4.4 | 1.8 |
| Not Hispanic or Latino, % | 93.7 | 93.0 |
| Race | | |
| American Indian/Alaska Native, % | 0.0 | 1.8 |
| Asian, % | 0.4 | 0.0 |
| African American, % | 42.5 | 14.0 |
| Caucasian, % | 51.2 | 78.9 |
| Other, % | 5.9 | 5.3 |

*Correlations among study variables*

| | 1. | 2. | 3. | 4. | 5. | 6. | 7. |
|---|---|---|---|---|---|---|---|
| 1. total books implemented | - | | | | | | |
| 2. total creative expressions implemented | .883** | - | | | | | |
| 3. total language/literacy implemented | .865** | .959** | - | | | | |
| 4. total math implemented | .820** | .939** | .975** | - | | | |
| 5. total science implemented | .825** | .930** | .962** | .967** | - | | |
| 6. total nutrition implemented | .922** | .976** | .984** | .969** | .966** | - | |
| 7. total physical activity implemented | .918** | .977** | .970** | .958** | .947** | .987** | - |

** Correlation is significant at the 0.01 level (2-tailed).