THE CORRELATION BETWEEN NUTRITION AND ACADEMIC ACHIEVEMENT IN GEORGIA MIDDLE SCHOOLS

by

Lesia A. Griffin

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

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ABSTRACT

Breakfast is the most important meal of the day and it is an important part of the academic achievement of students. Several hours after breakfast, the body requires more fuel. The fuel is used to energize the body and help feel refreshed. The wrong fuel may have the opposite effect. The primary objective of this correlation study was to determine if there was a relationship between the academic achievement, as measured by reading and math scores on the Georgia Criterion Referenced Competency Test (CRCT) of 8th grade students and their nutritional intake. The qualifications of the selected participants were that they were in a North Georgia middle school. This population was chosen because 8th grade is the only grade level in Georgia Middle Schools required to demonstrate academic achievement for promotion. These students were required to meet or exceed in reading and mathematics on the CRCT; therefore, they took the test more seriously. The results indicated that a significant negative correlation existed between nutritional intake and academic achievement for both math and reading.

Descriptors: *nutrition, achievement, middle school, child nutrition, academic*

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To my father, Marvin, thank you for drilling in me the importance of education. I hope I can continue to make you proud. In memory of my mother, Betty Adams, who always believed I could do any and everything, I love you and I know you would be proud!

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Table of Contents

List of Tables

List of Figures

List of Abbreviations

Adequate Yearly Progress (AYP)
Attention Deficit Hyperactivity Disorder (ADHD)
Center for Disease Control and Prevention (CDC)
College and Career Ready Performance Index (CCRPI)
Coordinated Approach of Child Health (CATCH)
Criterion Referenced Competency Test (CRCT)
Elementary and Secondary Education Act (ESEA)
Essential Fatty Acids (EFAs)
Georgia Department of Education (GaDOE)
High-density lipoprotein - Good Cholesterol (HDL)
Historical Black College and University (HBCU)
Individuals with Disabilities Education Act (IDEA)
Iron Deficiency (ID)
Kenya Certificate of Primary Education (KCPE)
Limited English and Proficiency (LEP)
Low-density lipoprotein - Bad Cholesterol (LDL)
National Cancer Institute (NCI)
National Center of Health Statistics (NCHS)
National School and Lunch Program (NSLP)
No Child Left Behind (NCLB)
Protein Energy Malnutrition (PEM)
Standard Error of Measurement (SEM)
United States Department of Agriculture (USDA)
Women, Infant and Children (WIC)
World Health Organization (WHO)

CHAPTER ONE: INTRODUCTION

The No Child Left Behind Act (NCLB) of 2001 was created to improve achievement of low-achieving students with an emphasis on math and reading (Forte, 2010). After passage of this act, educators were forced to pay more attention to the students who were at-risk of not meeting adequate progress on standardized tests than on students who made progress. Teacher quality was a major component to meeting the demand of NCLB. Teachers were now required to meet the state's required certification, hold at least a bachelor's degree, and show mastery in the content area. In addition, teachers had to attend multiple professional trainings provided throughout the school year. Although increased efforts were made on training and student performance, an area not addressed was the impact of children's diets on their performance. Consuming a well-balanced diet is necessary for health and growth and is an integral component of student academic performance (Shor & Friedman, 2009).

Providing nutritious food for children has been a concern for years. Nutrition during early childhood has an important influence on cognitive development and is most critical during the first 2 years of life (McAfee et al., 2012). Traditionally, during a child's toddler phase, parents understand that eating more fruits and vegetables will help develop the toddler's moods and mind. As the child gets older, parents place a smaller value on healthy nutrition intake and the role it plays on mental development.

As children grow and reach school age, they tend to spend more time at school than at home. During this time, parents depend greatly on schools to develop nutritional guidelines to support growing bodies. Federal meal programs help ensure that students receive healthy diets; however, educational programs are needed to teach students the importance of eating a healthy diet. Proper nutrition helps to enhance learning.

The researcher used a non-experimental correlation design to examine how a nutritional intake can affect the standardized reading and math test scores of 8th grade students. To evaluate academic achievement, the 2014 Georgia Criterion Referenced Competency Test (CRCT) reading and math scores were used. This chapter provides background information, a statement of the problem, the purpose, significance of the study, the research questions, the hypothesis and definitions of variables and definitions.

Background

In 2001, NCLB was developed to close the achievement gap among students of different nationalities and economic statuses, so that no child was left behind. NCLB caused school districts to be concerned about school-standardized test scores and highly qualified teachers. NCLB required all schools to make Adequate Yearly Progress (AYP) or face penalties that could reduce funding and increase scrutiny (United States Department of Education [USDOE], n.d.).

The NCLB required all schools to provide an annual report card on performance by district. The annual report card was used to document if a school meets AYP and closed the achievement gaps between minority and non-minority groups of students (USDOE, n.d). The USDOE explained that schools that did not make adequate gains for all students would be listed under the *needs improvement* category and be subjected to consequences (USDOE, n.d). These AYP gains were measured by standardized tests.

The CRCT was the standardized test used in Georgia (GADOE, n.d.). In 2000, the CRCT was implemented in Georgia schools for grades four, six, and eight in the areas of reading, language arts, and math. Georgia schools used the CRCT test in grades three through eight. The CRCT measured how well students learned a specific curriculum of instruction. The results of the reading and math tests could have affected a student's promotion to the next higher

grade. The Georgia Department of Education (GaDOE) required that students in eighth grade must meet or exceed on the CRCT to be promoted to the ninth grade. Some school systems made slightly different requirements for the other grade levels. Students who scored less than an 800 on the CRCT were considered *at-risk* students. Scores from 800 to 849 were considered as meeting the standard, and scores 850 or above were considered as exceeding the standard. According to NCLB and Individuals with Disabilities Education Act (IDEA), Georgia schools were mandated to develop methods to reach at-risk students (United States Department of Education, n.d.).

Although no longer used in 2015, the Georgia CRCT measured the academic performance by testing the knowledge and skills as set by the standards throughout the state. All teachers across the state followed the same test administration to ensure the integrity and security. All students were given the multiple-choice test in similar environments with the same time to complete.

A new assessment system has been developed since the completion of this study's proposal. The Georgia Milestones Assessment System, Georgia Milestones, is a comprehensive summative assessment for grades three through high school. Similar to the CRCT, Georgia Milestones measure how well students have learned the knowledge and skills outlined in the state-adopted content standards in language arts, mathematics, science, and social studies. In contrast to the CRCT, the Georgia Milestones offer open-ended, constructed-response, items in language arts and mathematics for all grades and courses (GaDOE, n.d.).

Academic performance is important, and it affects the future standard of living of individuals. Performing well in school usually increases the standard of living by making it easier to find stable employment with higher salaries, which may help to raise self-esteem and

lower levels of depression and criminal activity. Academic performance is also important to the nation because the economy shifted to dependence on a knowledge-based industry, as opposed to the manufacturing industry of the past. To remain competitive, the United States' educational system must bridge the achievement gap within its population (Chubb & Loveless, 2012).

Issues such as self-esteem, nutrition, health awareness, and socioeconomic status have been identified as challenges to academic achievement. This study focused on nutrition, specifically how healthy choices affect academic achievement. Proper nutrition is important for adults and children, and a lack of proper nutrition is a risk factor for child development (Shor, 2009). An improper diet can lead to obesity, diabetes, heart disease, genitive issues with children, and negative developmental outcomes (Shor, 2009). Generally, diet preferences are met at home according to family customs, prior to primary school influence, or are passed down from generation to generation (Smithers, Golley, Brazionis, & Lynch, 2011).

Poor diets, lack of breakfast, and improper nutrient intake are all possible reasons for poor academics and overweight children (Smithers et al., 2011). A poor diet consists of more than 10% of total calories from sweetened beverages, inadequate intake of fruits, vegetables, and whole grains, and an excess intake of dietary fat (Edwards, Mauch, & Winkelman, 2011; Florence, Asbridge, & Veugelers, 2008). Poor diets are high in sugar, which spikes blood sugar levels temporarily. To maintain alertness, blood sugar levels should remain constant.

The consumption of breakfast improves school attendance and enhances cognition for academic performance (Edwards et al., 2011). Edwards et al. also suggested that children who consume breakfast have a higher intake of vitamins A and C, calcium, iron, and zinc. Breakfast has also been proven to reduce fidgeting; however, it was believed that the quality of the instruction was also a factor in affecting behavior (Grantham-McGregor & Onley, 2006).

Taras' (2005) meta-analysis study showed that improper diets, improper nutrients, and lack of breakfast affect school performance and overall health. The majority of studies on children and nutrition focused on proper nutrition for children in poverty. These efforts are important; however, proper nutrition should be addressed with students who make a choice to eat poorly. Addressing poor diets may help students understand how the nutrients in fruits and vegetables protect the brain, memory, and the heart.

The theoretical framework for this study draws from three theories: Maslow's (1943) hierarchy of needs, Pollitt's (1973) undernourished child, and Jensen's 1998 teaching with the brain in mind. In Maslow's hierarchy of human needs, food is addressed as one the most basic of physiological needs, which is the most critical of the human needs (Gambrel & Cianci, 2013; McKenzie & Tullock, 2012). Pollitt built upon Maslow's theory by expressing that inadequate nutritional intake affects organ function, growth and cognitive development (Bryan et al., 2004). Jensen and Kiley (1998) discussed the importance of eating the required nutrients for optimal learning.

Problem Statement

The NCLB caused school districts to focus on school-standardized test scores because the scores showed the gaps in achievement. Public schools across the nation continue to struggle with persistent achievement gaps, and this challenge becomes even greater for schools with high poverty and high-minority populations (Nan & Zia, 2010). Minority students, specifically Hispanic and African Americans, have lower literacy scores than do other nationalities with many reading below a basic reading level (Nan & Zia, 2010). Improving the academic success of students living in high poverty and high minority areas concerned high equality schools, parent education, and proper nutrition (James, Jurich, & Estes, 2001). Increasing the awareness

of how nutrition intake positively affects academic performance is important (Johnston, O'Malley, Terry-McElrath, & Colabianchi, 2013).

Good nutrition is important for children to develop properly (Florence et. al, 2008). School systems have programs set up to reduce hunger and poor nutrition. Universal Breakfast and National School Lunch Program are two such programs. The Universal Breakfast program provides free breakfast for all students regardless of their income. The program was implemented based on previous studies that showed that a nutritious breakfast may decrease the number of undernourished students and increase academic performance (Kleinman et al., 2002)

The National School Lunch Program (NSLP) was established under the National School Act program of 1946. This federal assisted program ensured nutritional meals to children attending public and private schools. The NSLP has helped improve attendance and behavior for years by providing more nutritious lunches for children who may otherwise be hungry (Hinman, 2001; Mann, 2012).

School nutrition programs have faced scrutiny in current years (USDA, n.d.). In 2010, First Lady Michelle Obama launched the Let's Move initiative to reduce obesity by making healthier food choices and integrating exercise as a daily activity (Wojcicki & Heyman, 2010). This initiative was the first major revision to school meals in more than 15 years. The program requires that schools offer healthier food choices consistent with the United States Department of Agriculture's (USDA, n .d.) nutritional guidelines. In addition, the program encourages healthy food choices.

Although some research exists on nutrition and academic achievement, most exist to conquer childhood diseases or poverty. Universal Breakfast, NSLP, and the Let's Move initiative all improve the nutritional intake, behavior, and cognitive thinking of students while at

school; however, few studies show a correlation between the relationship between nutritional intake and academic achievement. The problem is the lack of empirical research available on the actual relationship between nutritional intake and academic achievement for students.

Purpose Statement

The purpose of this correlation study was to determine whether there was a relationship between the academic achievement and the nutritional intake of students. The variables were academic achievement, as measured by Reading and Math CRCT scores and nutritional intake. The findings of this study may help administrators, teachers, and parents understand whether a relationship exists between nutritional intake and academic achievement. This proposed study may provide stakeholders with evidence that emphasizes the importance of proper nutrition to help close the achievement gap.

Significance of the Study

The results of this study may be meaningful to cafeteria managers, district nutrition specialists, parents, teachers, administrators, and legislators. When the school stakeholders see a change in behavior or academic achievement, they may be more willing to implement healthier school lunch programs. Further, the results may help with health benefits such as reducing childhood illnesses and obesity.

Several research studies link student's dietary intake with their ability to learn; however, the significance of this study lies in discovering whether there is a relationship between nutritional intake and student achievement (Benton & Roberts, 1988; Taras, 2005). The dietary intake of previous studies measured the calorie intake or the amount of a specific vitamin or supplement. This study used the nutritional intake based on the major food groups as described by the USDA. In both the United States and the United Kingdom, experimental studies have

investigated how multivitamin and mineral supplements affect school age children's academic performance (Nelson, Naismith, Burley, Gatenby & Geddes, 1990; Schoenthaler, Bier, Young, Nichols, & Jansenns, 2000). In the United States, a few studies indicated that an iron deficiency could negatively affect math achievement; moreover, breakfast could positively affect cognitive skills (Bruner, Joffe, Duggan, Casella, & Brandt, 1996; Pollitt, 1997). In several countries, researchers associated undernourished school-age children with diminished academic achievement (Alaimo, Olson & Frongillo, 2001; Hall et. al, 2001; Ivanovic, Olivares, Castro, & Ivanovic, 1996). The results of this study merit attention because of the negative correlation between nutritional intake and academic achievement of 8th grade students in reading and math. The outcomes of the study may provide school administrators and stakeholders with a clearer understanding of the relationships between nutrition and academic achievement.

Research Questions

The purpose of this correlation study was to determine whether there was a relationship between the academic achievement and the nutritional intake of students. The research merits attention because researchers have associated undernourished school-age children with diminished academic achievement (Alaimo et al., 2001; Hall et. al, 2001; Ivanovic et al., 1996). This research was guided by the following research questions:

1. Is there a relationship between the academic achievement of 8th grade students, as measured by the math CRCT scores, and their nutritional intake?
2. Is there a relationship between the academic achievement of 8th grade students, as measured by the reading CRCT scores, and their nutritional intake?

Research Hypotheses

The research hypotheses that guided this research follow:

1. $H_{1:}$ There is a statistically significant correlation between the academic achievement of 8th grade students, as measured by the math CRCT scores, and their nutritional intake.
2. $H_{2:}$ There is a statistically significant correlation between the academic achievement of 8th grade students, as measured by the reading CRCT scores, and their nutritional intake.

The null hypotheses that guided this research follow:

1. $H_{01:}$ There is no a statistically significant relationship between the academic achievement of 8th grade students, as measured by the math CRCT scores and their nutritional intake.
2. $H_{02:}$ There is no a statistically significant relationship between the academic achievement of 8th grade students, as measured by the reading CRCT scores and their nutritional intake.

Identification of Variables

This study used a correlation research design to determine relationships between variables; therefore, the variables below are not described as independent or dependent (Gall, Gall, & Borg, 2007). This correlational study involved the comparison of two co-variables. For this study, the co-variables follow:

Academic Achievement – Academic achievement is defined as meeting an educational goal (GaDOE, n.d.). For the purpose of this study, the researcher specifically used student CRCT scores in math and reading as indicators of achievement that identified an eighth grade student who achieved a meet or exceeds score.

Nutritional intake - The Merriam-Webster (2013) dictionary defined nutritional intake as the daily intake of recommended allowances of nutrients. For the purpose of this study, the researcher specifically used only the allowances of fruits and vegetables.

Definitions

1. *Achievement gap* - The GaDOE (n.d) defined achievement gap as a reference to the observed disparity on a number of points between the performance of groups of students, especially groups defined by gender, ethnicity, and socioeconomic status
2. *Annually Yearly Progress (AYP)* – Under the guidelines of NCLB, AYP measured student's achievement on statewide assessments year to year (USDOE, n.d.).
3. *Criterion- Referenced Competency Test (CRCT)* – The CRCT was the standardized test used in Georgia during this study (GaDOE, n.d.). The CRCT was implemented in Georgia schools for grades four, six, and eight in the areas of reading, language arts, and math in 2000.
4. *Georgia Professional Standards (*GPS) /Common Core Standards (CCGPS) - A consistent framework of core standards provided for kindergarten through high school in English, language arts, and mathematics, and in grades 6-12, in literacy in science, history/social studies, and technical subjects (USDOE, n.d.).
5. *No Child Left Behind Act (NCLB)* – United States Department of Education (2007) defined NCLB as an act created to close the achievement gap with accountability, flexibility, and choice so that no child could be left behind in education.
6. *Standardized test* - A test administered and scored in a consistent manner (USDOE, n.d.).

CHAPTER TWO: LITERATURE REVIEW

An overview of the theoretical framework guiding the study is presented in this chapter. This chapter also reviews the importance of nutrition and the impact of improper nutrition on students. In addition, the research examines the importance of academic achievement, nutrition, and nutrition and learning for adolescents.

Introduction

Middle school students often make food consumption decisions based on taste and appearance. The foods that attract these students are not healthy. These students lean toward sweets, salty, or fast foods. Vendors of these unhealthy choices capitalize on these choices through advertisements and packaging. Environment, peers, and family also play a role in these food choices. The parents of these students often choose less expensive food, which may lack nutrients (Cook & Frank, 2008). Students base their knowledge of nutrition on their environment (Neumark-Sztainer, French, Hannan, Story, & Fulkerson, 2005). Students should understand the impact of food on the body and cognitive abilities (Alaimo et al., 2001; Briefel, Crepinsek, Cabili, Wilison, & Gleason, 2009; Calabrese Barton, Koch, Contento, & Hagiwara, 2005). Students should increase the consumption of fruits, vegetables, and whole grains to meet the recommended dietary guideline. Meeting the recommended dietary guidelines will help reduce the number of calories and fat, and increase the nutrients in student's diet (Florence et. al, 2008). Students, who consume low calories and fat, are more likely to pass literacy assessments and are less susceptible to illness (Florence et al., 2008; Fu, Cheng, Tu, & Pan, 2007).

The dramatic rise in obesity, cardiovascular disease, type 2 diabetes, and some cancers are other nutritional concerns. Fried and Simon (2007) found that obesity and inadequate food intake could lead to poor academic achievement and low achievers later in adulthood.

Inadequate food intake, such as skipping meals or not eating the proper dietary guidelines, may also cause malnutrition. Symptoms associated with malnutrition found difficulty concentrating, fatigue, irritability, dizziness, and frequent colds (McIntyre, Walsh, & Connor, 2001). Consuming more fruits and vegetables and other foods high in nutrients can help reduce many of the nutritional concerns (Zapata, Bryant, McDermott, & Hefelfinger; 2008).

The purpose of this correlation study was to determine if a relationship existed between the nutritional intake and academic achievement, as measured by the reading and math scores on the Georgia CRCT of 8th grade students. The theoretical framework used to direct the research for this chapter drew from three theories: Maslow's 1943 hierarchy of needs, Pollitt's 1973 undernourished child, and Jensen's 1998 teachings with the brain in mind. This framework will guide the researcher's review of the literature related to children's nutritional intake through the lens of physiological, cognitive, and achievement impacts. Academic achievement, nutrition, school nutrition, and nutrition and learning will also be discussed within this review.

Theoretical Framework

Maslow's Hierarchy of Needs Theory

Abraham Maslow is a recognized scholar in sociology and organizational behavior. Maslow originated three theories: (a) the theory of basic needs, (b) the theory of deficiency and growth motivation, and (c) the theory of meta-motivation and being values (Dmitry, 2008; Seeley, 1992). This study focused on the theory basic human needs. Maslow organized human needs into five general categories: (a) physiological needs, (b) safety needs, (c) belongingness needs, (d) esteem needs, and (e) self-actualization. Maslow used the five categories to construct hierarchy of needs. Poston (2009) described the needs in the following:

- Physiological needs—the basic needs influenced by cravings such as food and water
- Safety needs—the need to feel secure at home with comfort, warmth, and love

- Belonging needs—the need to social development
- Esteem needs—the need for self-respect, high esteem and acceptance
- Self-Actualization—satisfied with who you are

The most predominate needs in the hierarchy are the physiological needs (Seeley, 1992). The physiological needs represent those requirements for physical survival such as oxygen, food, liquid, shelter, and sleep (Seeley, 1992). Maslow's theory explains why nutrition is a basic physiological need required for physical well-being; however, he did not address how that basic need affects the cognitive behavior for the students (Poston, 2009). As the primary needs become satisfied, the next level of need is activated. Therefore, once physiological needs are met, a student can move to the next level of the hierarchy.

The ranking and the degree of need satisfaction determines the order the needs will motivate behavior. When students are hungry, their goal is to satisfy their hunger. The lower needs, physiological and safety, are the basic human needs, such as proper nutrition, food, water, and shelter, which must be satisfied before moving to the higher level needs (Gambrel & Cianci, 2003). Woodhouse and Mark (2012), described Maslow's esteem higher order needs tier as the need for acceptance and achievement; therefore, according to Maslow's hierarchy, the basic need of food must be satisfied before the desire for achievement. "Great academic performance cannot be expected from students experiencing basic needs deprivation" (Woodhouse & Mark, 2012, p. 3). McKenzie and Tullock (2012) explained:

> If all needs are unsatisfied, the organism is then dominated by the physiological needs; all other needs may become nonexistent or repressed. It is then fair to characterize the whole organism by saying simply it is hungry, for consciousness is almost completely preempted by hunger. All capacities are put into the service of hunger satisfaction, and

> the organization of these capacities is almost entirely determined by the one purpose of satisfying hunger. (p. 44)

A visual-depiction of Maslow's hierarchy of needs is represented in Figure 1.

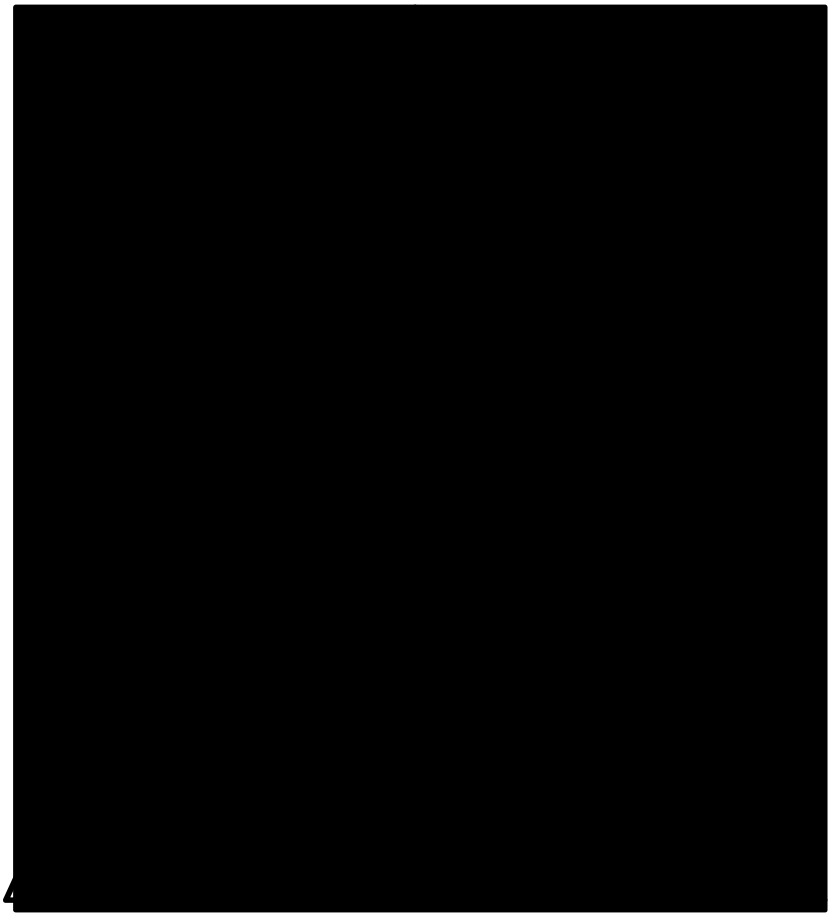

Figure 1. Maslow's hierarchy of needs.

Pollitt's Undernourished Child Theory

Ernesto Pollitt, a recognized author, studied preschoolers and schoolchildren to determine whether iron deficiencies were linked to cognitive development. Pollitt (1993) documented that children less than five years old with iron deficiencies (ID) performed lower on intelligence test and cognitive processes than did iron- sufficient children. The same results were

found with children six and older, which showed that independent of age, children with ID perform lower than those did with sufficient iron levels (Pollitt, 1993).

Pollitt continued to study the development of children by completing studies on the undernourished child. His studies evaluated the effects of energy, micronutrient deficits, and malnutrition on growth and development of children (Pollitt, Pollitt & Schürch, 2000). Pollitt et al. proposed a model to describe the developmental view of the undernourished child. The variables that affect cognitive development are dietary intake and morbidity, physical growth, motor development, motor activity, emotional regulation, caregiver behavior, exploration, and cognitive development. According to Pollitt et al. (2000), the variables that may affect internal processes follow:

- physical growth—when the micronutrient deficiencies may cause growth retardation
- motor development—gross and fine movement is delayed
- motor activity—the reduction in energy intake that reduces the amount of activity children should engage in
- emotional regulation—management of emotions

These variables are not independent of each other. For example, the particularly severe under-nutrition, Protein Energy Malnutrition (PEM), reduces muscle mass and fiber size, which affects both physical growth and motor development (Pollitt et al., 2000). The variables that involve organism and the environment are the caregiver behavior and exploration variables. Caretaker behaviors nurture children, foster growth and development, and protect them from illness and physical dangers according to the priorities of their social system (Pollitt et al., 2000). Exploration behavior describes the effects of malnutrition on psychobiological development (Pollitt et al., 2000). According to this model, caretaker and exploration behaviors depend on the

four internal processes for proper development. Dietary intake and morbidity is a deficiency of energy and micronutrients and can cause growth retardation (Pollitt et al., 2000). The four internal processes depend on dietary intake for proper development. To reach the cognitive outcome variable, all the variables must be developed as time passes.

Pollitt's theory discussed the influence of the basic needs of intellectual activity such as thinking, reasoning, and remembering (1995). Unhealthy eating, including under nutrition, affects health, growth, and intellectual ability. Under nutrition during childhood also affects the cognitive development of children (Bryan et. al, 2004). A hungry child cannot stay on task. When a child is undernourished, his or her body conserves the food energy to maintain critical organs and growth (Jahari et al., 2000). The activity levels decrease and children lose interest when undernourished, which affects the ability to reason, think, and remember (Pollitt, 1998). The longer a child's nutrition needs go unmet, the greater the cognitive deficits (Pollitt, 1998).

Under nutrition can trigger chronic health problems, extreme weight loss, stunted growth, weaken resistance to infection, and early death in children (Brown & Pollitt, 1996). Early scientist believed that proper nutrition was only important until the brain was 80% of an adult size brain, or approximately age two (Brown & Pollitt, 1996). It is now understood that structural damage to the brain can happen later in life with inadequate nutrition. Inadequate nutrition can disrupt cognition and impair the intellect.

Jensen's Teaching with the Brain in Mind Theory

Pollitt (1998) posited that children should eat to decrease undernourishment for cognitive development; however, he lacked information on eating for learning. Jensen and Kiley (1998) discussed the importance of eating the required nutrients for optimal learning. The nutrients in food necessary for learning include proteins, unsaturated fats, vegetables, complex

carbohydrates, and sugars (Jensen & Kiley, 1998). Jensen (2008) explained that vitamins and minerals from the right food could boost learning memory and intelligence.

Exposure to poor nutrition negatively affects student's academic achievement and cognitive abilities (Basch, 2011). Poor nutrition also makes it harder to listen, concentrate, and learn, which may cause students to exhibit problem behaviors or show signs of helplessness (Jensen, 2009). The brains of some students from poverty are different from some students who are not from poverty because of the brain neurons that are designed to reflect our environment (Jensen, 2009). The working memory, impulse regulations, visouspatial, language, cognitive capacity, and conflict are areas of the brain affected by chronic exposure to the environment (Jensen, 2009). Exposures to toxins, such as artificial additives and coloring in food, lead, noise, or smog, impose stressors on the brain. Chronic stress causes adjustments to the body's stability and brain, which increases the likelihood of emotional problems, low IQ, reading scores, significant memory loss, anger, aggression, or even helplessness (Jensen, 2009).

Students from poverty typically have cognitive skill deficits because of the different vocabulary words used at home by parents, lack of books in the home, and the lower quality of nutritional intake (Parett & Budge, 2012). Students from poverty are more likely to have impaired emotional-social relationships than do their counterparts. This is because of less parental support, interactive conversations, extended periods of time alone, and extensive amounts of television per day (Jensen, 2009). These impaired relationships can affect their self-esteem and everyday choices.

New brain cells are produced daily; therefore, the brain can be changed with good experiences (Jensen, 2009). Students have an active neuron system that mirrors what they see. It is important they see and develop relationships with teachers and other students (Jensen,

2009). To change the brain functionality, students should also exercise to build more neurons and to increase cognitive development, set goals, dream to build hope, and have their basic needs of food and shelter met (Jensen, 2009).

Academic Achievement

Since the publication of *A Nation at Risk* in 1983, the federal government has attempted to improve the educational system (Smyth, 2008). In 1983, the National Commission on Excellence in Education began. In 1994, standards-based curriculum was implemented at the state level (Kress, Zechman, & Schmitten, 2011). The Goals 2000 Educate America Act and the 2001 NCLB were created to increase student achievement and impose consequences on schools for their lack of performance (Kress et al., 2011). Prior to these acts, standardized testing was the only way to measure student and teacher performance. NCLB had the same concept as the other acts; however, it was extended to ensure a quality education for all children and to close the achievement gap among minority students. NCLB required all schools to bring their students up to grade level in math and reading by 2014; however, each state could create its own plan to meet that requirement (Kress et al., 2011). Any schools that failed to meet their yearly goal were said to have not made AYP. Schools that did not make AYP were labeled as a needing improvement and were subject to escalating interventions.

NCLB was created to guarantee certain educational issues: (a) every child in America would read on grade level and compute high-level mathematical problems, (b) every teacher would be highly qualified to educate students, (c) and every school would make AYP (Smyth, 2008). NCLB was developed to define students' knowledge and ability levels; the students should be able to demonstrate what they knew in each content area and grade level (Forte, 2010).

In 2012, Georgia developed college and career ready performance index (CCRPI) to replace the 2004 AYP measure under NCLB. The U.S. Department of Education granted a waiver to Georgia to replace the Federal Education Reform, Elementary and Secondary Education Act (ESEA) part of NCLB with CCRPI. The 2013 CRCT results measured progress on accountability indicators such as content mastery. Student attendance varied by grade. The waiver removed the requirement that all students must be proficient in reading and math by 2014. The CCRPI ensures that schools will focus on improving achievement for all students.

All schools in Georgia receive an accountability report, which is reviewed by school council and leaders. The accountability report is the school's annual report on effectiveness based on several measures. It is common for the school plans of improvement to have a goal to increase academic achievement based on the accountability report. The achievement data calculated from the CRCT allowed schools to identify gaps by subgroups: (a) all students, (b) race/ethnicity (Alaskan Native, Asian/Pacific Islander, Black, Hispanic, Multiracial, and White), (c) students with disabilities, (d) Limited English Proficient (LEP), and (e) economically disadvantaged.

Achievement might be a subjective issue based on the value placed on the outcome. Often, students determine their ability based solely on their grades and assessments. Research shows schools should use three forms of feedback and assessment: (a) summative, (b) formative, and (c) diagnostic (Nicol & Macfarlane-Dick, 2006). Diagnostic assessments should give students and teachers' feedback to help with troubleshooting. Formative assessment should give constructive feedback for the students to improve the weaknesses and understand their strengths. Summative assessment should provide the final feedback on the topic. Todd, Mcilroy, and

Bunting (2009) suggested that students' coursework be assessed by both the process and the product of their work.

Gerzon-Kessler (2006) gave five fundamental principles for boosting achievement in struggling students: (a) convey a sense of urgency, (b) develop personal bonds, (c) develop a joy for learning, (d) raise the bar with high expectations, and (e) cultivate social and emotional intelligence. Teachers should solicit assistance from students, parents, and colleagues to convey a sense of urgency. This sense of urgency would suggest to students that teachers care and respect them. Fostering a joy for learning is done by having enthusiastic activities to keep the students engaged. Gerzon-Kessler (2006) stated that as the students experience success they will continue to have a commitment to excel, which is why teachers should have high expectations for all students. Gerzon-Kessler's findings supported the findings of Maslow (1943), which stated that a student must have basic needs met before reaching the esteem level. Gerzon-Kessler assumed that students must understand that learning is just as important as a basic need to begin the process of academic achievement.

Student may also have poor academic achievement because of the low expectations of parents and inexperienced teaching staff. Some schoolteachers are not encouraged to determine the students' learning preferences and usually teach traditionally where students sit down, listen, and memorize standards (Glenn & Van Wert, 2010). These traditional methods of teaching may not be an effective teaching tool for all students. Researchers argued that because of the physical and chemical differences between boys' and girls' brain cells, their leaning styles will be different; therefore, boys sit silently while girls enjoy collaborating (Glenn & Van Wert, 2010).

Nutrition

The importance of eating a healthy diet has been a focus of researchers for many years. Nutrition plays an important part in the growth and development of children. In 1941, the USDA (n.d.) created the first recommended dietary allowances. Several other nutritional guides have been created since 1941. Early nutritional standards focused on the basic seven foods that should be consumed by individuals each day (Totapally & Raszynski, 2013). A decade later, the program was obsolete, when the USDA (n.d.) introduced the Basic 4 program. About 25 years later, the food guide pyramid provided the recommended servings of each food group. Years later, the food guide pyramid was replaced with MyPyramid to represent exercise portion sizes (USDA, 2005). More recently, the USDA (n.d) replaced MyPyramid (Fig. 2) with MyPlate (Fig. 3). MyPyramid was based on protein and processed foods; it displayed the six good groups of the past. MyPyramid was criticized for not distinguishing clearly between healthy and non-healthy choices. MyPlate, however, presented the evolution of the recommendations made by the USDA to include an increase in total vegetable and fruit intake. The illustration of MyPlate shows what in each food group an individual should consume in a meal. The vegetable portion of MyPlate is slightly larger than the grains. These changes, along with many others, were implemented to help Americans make healthier nutrition choices. Other programs, such as 5 A Day, created in 1991 by the National Cancer Institute (NCI [Serdula, Solera, Cobb, & Crowell, 2005]) and Fruits & Veggies- More Matters, created in 2007 by the USDA (2015), were also created to increase the knowledge and the importance of consuming adequate nutrition by increasing fruits and vegetables.

Figure 2. USDA - MyPyramid. Reprinted from USDA. Retrieved from http://www.choosemyplate.gov/. Reprinted with permission.

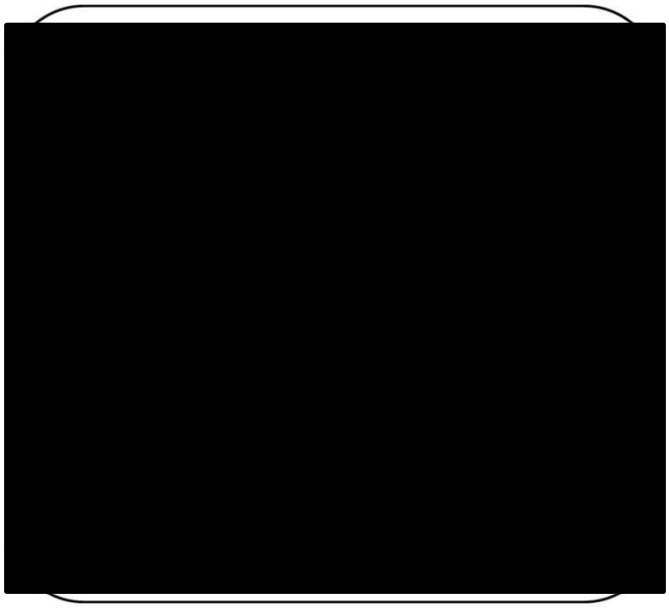

Figure 3. MyPlate. Reprinted from USDA. Retrieved from http://www.choosemyplate.gov/. Reprinted with permission.

School Nutrition

Since 1906, when poverty caused students not to learn because of a weak condition, nutrition has affected student achievement (Pimpare, 2011). Nutritional deficiencies also affected men drafted for World War II. Because of the need to defend the country and the student's need for adequate nutrition, Congress passed the School Lunch Act (Martin & Oakley, 2008). In 1946, President Truman signed the National School Lunch Act to safeguard the health of the nation's children (Stallings & Taylor, 2008). Two decades later, an amendment was added to the National School Lunch Act titled the Child Nutrition Act. The Child Nutrition Act was created as a pilot project to provide breakfast for low-income children for a free or discounted rate (Kennedy & Davis, 1998). A few years later, the National School Lunch Act was amended to include the free lunch program, and the Child Nutrition Act made the School Breakfast Program permanent (Kennedy & Davis, 1998; Stallings & Taylor, 2008).

Nutritional benefits for consuming breakfast for children include improving cognitive function, memory, and school attendance (McKevith & Jarzebowska 2010). The initial goal of the School Breakfast Program was to increase student's abilities to learn by preventing hunger prior to lunch (Martin & Oakley, 2008). Studies have shown that eating breakfast improves attention (Pivik, Tennal, Chapman, & Gum, 2012; Vaisman, Katzman, Carmiel-Haggi, Lusthaus, & Niv, 2010). In 1995, the school meal initiative for healthy children, one of the national school lunch and school breakfast programs, increased the vegetables, fruits, and grains in a traditional meal (Stallings & Taylor, 2008). The National School Act was amended in 2006 to introduce new fresh fruits and vegetables to school age children. Finally, in 2010, the Healthy, Hunger Free Kids Act was enacted by President Obama to help raise healthier children by aligning meals

to nutrition (Stallings & Taylor, 2008). According to the USDA (n.d.), the meal changes provide students with the following:

- daily fruits and vegetables
- larger quantities of vegetables
- fat free or low fat milk
- restricted calories requirements for the age of the child

The vegetables served each week must include both dark green leafy vegetables and red/ orange groups. Approved vegetables are collard greens, kale, turnip greens, broccoli, spinach, romaine lettuce, squash, carrots, pumpkin, and sweet potatoes (Healthier US School Challenge, 2011). In 2013, half of the school lunches had to be whole grains. In 2014, half of the breakfasts had to be whole grains. By 2015, all grains offered in school meals had to be whole grains (Federal Register, 2012).

School nutrition programs are federally assisted and do not financially depend on the local school system. Programs that need additional funding may sell a less healthy food option called a la carte with the school meal (Martin & Oakley, 2008). A la carte foods include but are not limited to pizza, fries, friend chicken strips, cookies, and chips. Student participation in NSLP decreased when a la carte options are available (Cohen, Sturm, Lara, Gilbert, & Glee, 2010). Larson and Story (2011) found that about 80% of middle schools in the United States serve a la carte foods, and only 14% of those have healthy options.

Effects of school nutrition. It is important for children to have healthy eating habits, and the school contributes to this behavior. School is a natural place to promote healthy eating habits because children receive one-third of their caloric intake from foods consumed at school (Briefel, Wilson, & Gleason, 2009). The 2005 Dietary Guidelines for Americans recommends

five servings of vegetables a day; however, most adolescents only consume 40% of the daily amount (Stallings, Suitor, & Taylor, 2010). Students who participate in NSLP consume more fruits and vegetables than those who do not (Condon, Crepinsek, & Fox, 2009). Students who do not participate in NSLP consume more foods served via a la carte, vending machines, school stores, and fundraisers (Ishdorj, Crepinsek, & Jensen, 2013). A recent study of middle school students in the upper Midwest found that a la carte and vending machines negatively affected the daily intake of fruits and vegetables (Kubik, Lytle, Hannan, Perry, & Story, 2003). Participation in the school lunch program and restriction of the availability of snacks and a la carte foods in schools will help increase fruit and vegetable consumption (Gonzalez, Jones, & Frongillo, 2009).

Ishdorj et al. (2013) discussed the effects of the school environment and policies on intake of fruits and vegetables at home. The sample included 2,314 school age students from 287 schools and collected data by using the 24-hour dietary recall, parent interviews, and observations. The finding concluded that NSLP participants increased their consumptions of fruits and vegetables at school and reduced the fruits and vegetables away from school; however, the total consumed by participants in the NSLP was still more than students who did not participate in the NSLP (Ishdorj et al., 2013).

Diet Quality

Diet quality in the United States is worsening, physical activity is drastically declining, and obesity is rising (Oz, 2011; Popkin, Adair, & Ng, 2012). Eating away from home, consuming processed foods, and using pre-prepared meals are becoming a way of life for many people. The high intake of refined carbohydrates, added sugars, fats, and animal-source foods can cause an array of health conditions and obesity (Popkin et al., 2012). In 2010, individual intakes of inexpensive vegetable oils increased between three- and six-fold (Popkin et al., 2012).

In addition, diets around the world have a higher consumption of sugar. In the United States, about 75% of foods and beverages contain added caloric sweeteners (Popkin et al., 2012). The average American between the ages 2 and 17 years consumes about 375 calories of caloric sweeteners a day with diets half as nutritious as recommended (Fungwe, Guenther, Juan, Hiza, & Lino, 2009; Popkin et al., 2012). Two-thirds of added sugar consumed comes from beverages, and this excludes fruit juice from concentrate, which is also a source of sugar (Popkin et al., 2012; Zapata et al., 2008). Changing personal food preferences to fruit and vegetables can be difficult; however, repeated exposure of a food can change a student's acceptance of the food (Cullen, Watson, & Konarik, 2009). Organizations such as the World Health Organizations (WHO) are working on regulations to minimize or eliminate marketing less healthy foods and finding ways to control consumption of sugary beverages, including 100% fruit juice, sports drinks, and vitamin waters (Popkin et al., 2012).

Consequences of Nutrition Preferences

Poor eating habits of children are a concern that can develop into greater problems as adults. Over the past decade, obesity and other nutrition-related adult illnesses, such as cardiovascular disease, high blood pressure, and type 2 diabetes, are increasingly diagnosed in children (Oz, 2011; Popkin et al., 2012). These diseases are likely due to the change in diets to include more processed foods, increased away-from-home food intake, and increased use of edible oils and sugar-sweetened beverages.

Increases in the rates of people who are obese and overweight are widely documented in the United States, with more than half of adults in some subpopulations, age, gender, race, or ethnic-specific, being overweight or obese, which includes more than a third of children (Oz, 2011; Popkin et al., 2012). In 2008, adults worldwide were considered either overweight or

obese; however, overweight or obesity is increasing (Popkin et al., 2012). Doctors are also concerned about the rise in obesity in children. Obese children face health-related concerns such as diabetes, asthma, sleep apnea and social discrimination (Wojcicki & Heyman, 2010). Children who are obese often become obese adults.

Consuming a controlled amount of calories from the right foods, such as fruits, vegetables, whole grains, and legumes, can help to reduce obesity in both children and adults. African American girls are more likely to eat fruits and vegetables five or more times a day; however, they also consume more fast food and have a higher obesity rate than do European American girls (Cullen et al., 2009; Gordon-Larsen, Adair, & Popkin, 2003; Schmidt et al., 2005). Decreasing dietary fat consumption improved academic achievement, and lowered cholesterol, blood pressure, and the risk of non-communicable diseases in children up to 14 years of age (Florence et al., 2008; Popkin et al., 2012). Monounsaturated fats, such as canola oil and olive oil, and polyunsaturated fats, such as omega-3s, have been found to lower the bad cholesterol (LDL) and raise the good cholesterol (HDL), which reduces the risks of atherosclerosis and heart disease and increases brain health (Oz, 2011).

Reducing salt intake is a benefit to health. The human heart cannot beat without salt; however, too much sodium can increase blood pressure to dangerous levels, especially among African Americans. Dark chocolate and coffee are both sources of antioxidants associated with lower incidences of dementia, Parkinson's disease, and type 2 diabetes. Oz (2011) stated there was no significant difference among skim, low-fat milk, and whole milk in weight control because milk can help control weight by helping the body to absorb less fat. Moderation and making good choices are the keys to all food consumption.

Nutrition and Learning

Nutrition can influence the development and health of the brain structure and function for improved cognition and academic performance. Basch (2011) found that children who skip breakfast display decreases in cognitive performance and the ability to problem solve. Children who are under or over nourished may have deficits in academic achievement and be more susceptible to brain structure decay during aging (Burkhalter & Hillman, 2011). Burkhalter and Hillman (2011) also found that individuals aged 19-33 show improved attentiveness and motivation after consuming a well-balanced meal.

The achievement data received from the CRCT on the economically disadvantaged is based on low income Americans. The USDA provided a nutrition insight of the diet quality of low and high income Americans based on the Healthy Eating Index of 2005 (HEI-2005 [Guenther et al., 2005]). HEI-2005 measured the compliance of the dietary guidelines, total fruit, whole fruit, total vegetables, dark green and orange vegetables, legumes, total grains, whole grains, milk, meats, beans, oils, saturated fat, and sodium (Guenther et al., 2009). One day of dietary intake data was provided to 8,272 low-income participants aged 2 years and older. Guenther et al. (2009) defined low income as eligibility for food stamps or the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). The results indicated that low-income families were below the maximum possible score for all components except for total grains, meat, and beans. Low-income families' total vegetables and whole grains were significantly lower than higher income families. The children of the low-income families consumed more vegetables than did children from higher income families; however, both groups were below the maximum (Guenther et al., 2009).

Guenther et al.'s (2009) study shows that all children, regardless of their socioeconomic level, are at risk of improper nutritional intake. Some children cannot afford sufficient food; others consume enough food, but their diets are not based on the USDA guidelines. Children not receiving proper nutrition affect physical health, brain function, learning, and behavior (Dani, Burrill, & Demming-Adams, 2005). Essential fatty acids (EFAs) deficiency yield symptoms similar to attention deficient/hyperactivity disorder (ADHD). Children with ADHD and young adult prisoners showed improved mood and behavior after receiving high doses of multiple mineral and vitamin supplements (Dani et al., 2005).

In another study, students in Phoenix, Arizona where given a low dose vitamin-mineral tables, and the students in the active group gained 15 or more points on an IQ test. Protein, iron, and iodine also affect a child's learning abilities. Protein deficiencies affect a student's intelligence, cognition, and behavior (Dani et al, 2005). Iron deficiency affects cognition and behavior, but through the brain enzymes (Dani et al, 2005). Deficiencies in iodine causes lower motivation and slower learning (Dani et al, 2005). According to Dani et al., a more nutritious diet with plenty of vegetables, fruits, and whole grains may produce higher achievement levels and protect against chronic diseases.

Cognitive Development

Cognitive development begins three weeks after conception when activity occurs in the brain's structure (Healy, 2004). Human interaction occurs when the neutrons, which develop at the age of one, communicate with each other (Woodhouse & Mark, 2012). The human body, including the neurons, derives energy from food. To improve cognition and academic performance, it important that the brain has proper nutrients (Burkhalter & Hillman, 2011).

During childhood, the brain's energy needs are heightened; therefore, good nutrition is important (Woodhouse & Mark, 2012).

The cognitive process also embodies goal setting and self-appraisal. Students with a high sense of efficacy can visualize success and positive performance. Students who doubt their efficacy visualize failure and dwell on what can go wrong. Therefore, students with the same academic abilities may perform poorly or extraordinarily depending on self-efficiency thinking (Bandura, 1993).

Dehydration is another common nutritional problem connected to academic achievement and cognitive development. For optimal performance, the brain needs at least eight glasses of water a day. Severe dehydration can affect cognitive functioning, body systems, and be life threating (Arnaud & Noakes, 2011).

Nutrition education. In middle school, students are more aware of their bodies. Students should learn what they put inside their bodies is as important as their appearance. Advertisers can give misleading information; therefore, it is import to make sure students receive the proper nutritional education, especially during these times, because teens spend a lot of time surfing the web.

Educating students on health not only helps with proper nutrition, it also helps with academic achievement. A study conducted with third and fourth grades students who received health education revealed those students who received the health education scored significantly higher in reading and math than did students who did not receive the education (Eggert, Thompson, Herting, Nicholas, & Dicker, 1994). The program not only improved test performance, it also improved attendance and behavior.

Relevant Studies in Nutrition Education

EatFit impacts sixth graders' academic performance on achievement of mathematics and English education standards. Shilts, Lamp, Horowitz, and Townsend (2009) conducted a quasi-experimental study of academic achievement. The problem identified by Shilts et al. (2009) was the lack of research on nutrition education and academic performance. The purpose of their study was to investigate the impact of a nutritional education program on student academic performance.

The study used the nutritional education program EatFit with the dietary and behavior skills of adolescents 11-14 years old. EatFit was used to help adolescents improve their eating habits. Shilts et al. (2009) concepts were based on the social cognitive theory. The Social cognitive theory is based on learning new information while observing others. Social cognitive theory was chosen based on the three underlying strategies used in the intervention: (a) self-efficacy, (b) out-come expectancies, and (c) self-regulation. These strategies are reached during the belongingness tier of Maslow's hierarchy where social connections are developed.

Shilts et al. (2009) provided one major research question: What is the impact of EatFit on sixth grader's academic performance on achievement of mathematics and English education standards? Five standards for sixth-grade math and English were assessed using a multiple choice evaluation tool in Shilts et al.'s study. The researchers conducted their study with 95 sixth grade students. The demographic breakdown was 50% female, 1% Black, 5% Asian, 27% White, 32% Hispanic, 35% multiethnic, and 58% qualified for free or reduced price lunch (Shilts et al., 2009). The students received an EatFit workbook. In addition, they were given a web-based assessment that included a 24-hour diet record, dietary feedback, goal setting, and a contract. The assessment was given three times during the fall semester, the first week, for

baseline data, the 5th week, and the 10th week. During the first five weeks, the students received normal instruction, and during the last five weeks, the students received EatFit instruction.

To address the major research question, the researchers conducted a quasi-experimental crossover-controlled design using SAS. A paired *t* test was used to determine whether the instruction differed significantly between week 1, 5, and 10 (Shilts et al., 2009). According to the data, listening and speaking, mathematical reasoning, and algebra functions were statistically higher after the intervention periods.

Shilts et al.'s 2009) study demonstrated the nutrition education program academic performance for the sixth grade students. Data also indicated the students' dietary behaviors, dietary self-efficacy, physical activity behaviors, physical activity, and self-efficacy levels (Shilts et al., 2009). Although the study demonstrated an impact on academic performance using the nutrition education program, limitations to the study existed. There is a lack of studies to compare the results because a comparison to nutrition education and academic performance as measured by standards has not been previously reported (Shilts et al., 2009). Shilts et al.'s study also included participants from one school and only two classrooms; therefore, lack of generalization could have affected the results.

Nutrition status, education participation, and school achievement among Kenyan middle schoolchildren. Mukudi (2003) conducted a correlation study to examine the effects of the nutrition status of eighth-grade school achievement scores in Kenya. Identified by Mukudi (2003), the problem was a decline in attendance and achievement scores because of increasing poverty levels. The purpose of the study was to examine the effects of nutrition on school attendance.

Mukudi (2003) provided one major research question: What are the effects of nutrition status on primary school achievement scores for the eighth-grade class of 1997? The researcher conducted his study with five public schools to reflect the socioeconomic differences within Trans Nzoia District of Kenya. Unlike the United States where schools are zoned by residence, Kenyan parents enroll by affordability. The schools are divided into socioeconomic clusters: low income urban, low-income peri-urban, low-income rural, middle-income urban, and upper-income urban. The demographic breakdown was 851 sixth, seventh and eighth grade students aged 10 to 20 years old (Mukudi, 2003). The height, weight, and age were obtained in the third quarter as part of the calculation to obtain the nutrition status. The attendance records were used to verify the birth data given by the students. The clothing was limited to the school uniform. The students were weighed two consecutive times to check for accuracy and reliability (Mukudi, 2003).

To address Research Question 1 in Mukudi's study (2003), the researchers conducted a statistical analysis using descriptive statistics and correlation analyses using SPSS. The National Center of Health Statistics (NCHS) anthropometric data sets were referenced to compute the nutrition measure (Mukudi, 2003). Attendance rates were computed as a percentage; the Kenya Certificate of Primary Education (KCPE) exit examination scores for 8th graders were the achievement score.

Mukudi's (2003) study demonstrated that nutritional stress is a significant educational factor in children. High attendance rates and adequate nutrition were evident in the association of higher achievement among students in higher income school categories. Absenteeism was more common in the lower grades than in the exit grades (Mukudi, 2003). The study also

included a wide range of ages for the participants; therefore, student experiences could have affected the results.

Closing the achievement gap: strategies for ensuring the success of minority students. Li and Hasan (2010) used teachers to determine if cognitive and non-cognitive measures affected academic performance. This study also showed that academic achievement could be achieved by measures other than intellectual abilities. Li and Hasan conducted a qualitative study of academic achievement among high poverty and high minority populations. The problem identified by Li and Hansan was achievement gaps in schools with high-poverty and high minority populations. The purpose of the study, as identified by Li and Hansan, was to identify the factors that promote academic success in minority students.

Li and Hansan (2010) examined the academic success of minority pre-service teachers. Pre-service teachers were used to resemble the success of minority students to determining factors for success. Li and Hansan's concepts were based on cognitive and non-cognitive measures. The cognitive measures referred to mental or intellectual ability, and non-cognitive measures referred to personality traits. Cognitive measures were linked to student academic achievement; however, many non-cognitive factors supported the achievement (Li & Hansan, 2010).

Li and Hansan (2010) provided one major research question: What factors promote academic success in minority students? The researchers conducted their study with two groups of students enrolled in the teacher education program at a historical Black college and university (HBCU). The two groups included 78 pre-service teachers who were African American participants and non-participants. The students received a four-page qualitative survey

questionnaire and interviews to clarify responses as needed. The questions in the survey focused on past learning, present learning, and a reflection on the learning process.

To address Research Question 1, Li and Hansan (2010) conducted a qualitative data analysis of coding to find patterns among data. In the first category, past learning, students who were participants in the program were optimistic and had good teacher-student relationships. Students who were non-candidate participants were negative and had no good experiences. In the second category, present learning, participants in the program were more organized and had great work ethics than did the students in the non-candidate participant group. The last category was a reflection on their learning. Participants in the program revealed determination, hard work, self-motivation, and family support. The responses from the non-candidate participants revealed disciplinary weaknesses.

Li and Hansan's (2010) study demonstrated that minority students need a supportive and positive learning environment. The findings provided four strategies for teachers to consider for academic achievement. Teachers should build confidence and self-esteem, provide a positive academic environment, time to engage in actual learning activities, and foster positive teacher-student relationship. Although the study demonstrated an impact on academic achievement using cognitive and non-cognitive factors, limitations to the study existed. The study compared different socioeconomic groups; therefore, lack of generalization could have affected the results.

Assessing how middle school students' nutrient intake varies based on the availability of a la carte offerings at lunch. Weiss (2012) delved into Pollitt's theory of an undernourished child motor activity by researching the reduction of energy intake. Weiss conducted a cross-section design for direct observations of six and seventh grade student lunch consumption. The problem identified was lack of research on the quality of menu items

available to and consumed by middle school students. The purpose of the study was to compare two methods of offering a la carte foods on students' lunch intake. One method was an extensive a la carte program in which schools had a separate area for a la carte food sales that included non-reimbursable entrees. The second method was a moderate a la arte program, which offered the sale of a la carte foods on the same serving line with reimbursable meals.

Weiss's (2012) study was the first to compare study energy consumption across different a la carte programs. The schools selected for the study were chosen based on their level in Coordinated Approach to Child Health (CATCH) Program. According to Weiss, CATCH nutrition use in children increases school performance. Schools in this program were assigned to one of the three interventions. Level 1 intervention included materials and training. Level 2 included materials, training, and implementation facilitation. Level 3 included all of the above and an in school marketing campaign. The study provides data on the calories middle school students consume from a la carte foods during lunch at school (Weiss, 2012). Weiss provided three major research objectives follow:

- To determine differences in student intake of energy and macronutrients based on lunch source during school lunch.
- To examine of energy and macronutrient difference in student's intake in two types of a la carte programs.
- To examine the contributions of a la carte foods toward middle school student's dietary intake and energy dense food consumption at school lunch.

Weiss (2012) conducted the study with 333 students. The students were from six middle schools from two districts in Central Texas. The demographic breakdown was 19% African American, 49% Hispanic, and 26% European American students (Weiss, 2012). Data collectors

collected information on the foods obtained, food consumed, source of food, gender, grade, and ethnicity (Weiss, 2012). Lunch observations were divided into six categories: (a) NSLP only, (b) a la carte only, (c) sack lunch only, (d) NSLP and a la carte, (e) sack lunch and NSLP, and (f) mixed source, which included a combination of the three lunch sources. The data collectors observed the students without communication or interaction.

To address Objective 1, the researcher-identified that students who consumed only a la carte foods ate significantly fewer calories, carbohydrates, sodium, and energy dense foods than did the students who consumed the NSLP meals (Weiss, 2012). Students who consumed only a la carte consumed more energy dense foods; therefore, the more food sources consumed, the greater the energy intake and macronutrients (Weiss, 2012). The students in this category were below their caloric lunch intake and exceeded the recommendations for sodium.

Objective 2 as identified by Weiss (2012), found students who consumed mixed sources consumed more calories and fat than the other lunch sources. These students energy intake was below the recommendations. However, if the a la carte was extensive, students consumed more energy, protein, carbohydrate, fat, and sodium. Finally, in Objective 3, Weiss (2012) identified no significant difference in energy between students who consumed any a la carte foods compared to those students who did not consume any a la carte foods. No significant difference in the nutrient intake between students who consumed extensive a la carte meals was found compared to those who consumed moderate a la carte meals.

Weiss's (2012) study demonstrated that students who increased the a la carte food consumption did not significantly reduce the energy consumption; however, it promoted unhealthy food choices for the remaining meals. A limitation in the study was the potential for

students to be observed twice because students did not have assigned seating. Another limitation was the lack of generalization because schools were not chosen based on demographics.

Summary

Chapter 2 includes a review of the literature and studies regarding academic achievement, nutrition, and nutrition and learning. The literature review included the theoretical foundation of nutrition and academic achievement, and the theories of physiological, cognitive and achievement. Relevant studies were reviewed and analyzed to understand nutrition and learning.

Based on the review of literature, academic achievement, proper nutrition, and growth development have been a concern for many years. Federal, state, and local schools have worked diligently to develop ways to close the achievement gap and increase student academic performance. The majority of the available research involved various motivational efforts and self-efficacy as adequate ways raise academic achievement.

Obesity and food insufficiency is on the rise with students in the United States. These health issues can cause hypertension, diabetes, and cardiovascular disease. Decreasing the fast food consumption and eating a well-balanced meal are needed to protect students. The NSLP and Healthy Hunger Free Kids Act will help to implement nutritional changes in the meals served in schools.

The literature showed the importance of having a well-balanced meal. Studies revealed that skipping breakfast could have a negative impact on class performance. According to the literature, this is noticed more in students who are poorly nourished or deficient in iron or other important supplements. To improve the nutritional intake, the NSLP offered free or reduced lunch and breakfast to students who qualified. This current study sought to determine whether a relationship existed between academic achievement and nutritional intake.

CHAPER THREE: METHODOLOGY

Introduction

The purpose of this correlation study was to determine whether there was a relationship between the academic achievement and the nutritional intake of students, as measured by reading and Math scores on the Georgia CRCT of 8th grade students. This study investigated whether proper nutrition has a role in closing the achievement gap. The information from this study may help administrators, teachers, and parents understand the relationship between nutrition and academic performance.

Research Design

This quantitative research study used a bivariate correlational research design to investigate the problem and examined the relationship between the academic achievement of 8th grade students and their nutritional intake. Cooper and Schindler (2006) stated that quantitative research minimizes bias by using the analysis of objective numerical data. A correlational research design is used when the relationship between two variables is assessed (Jackson, 2011). This bivariate statistics was chosen to define and examine the strength of the relationship between two variables (Gall et al., 2007). Gall et al. (2007) stated, "The basic design in correlational research is very simple, involving nothing more than collecting data on two or more variables for each individual in a sample and computing a correlation coefficient" (p. 335).

The purpose of correlational research is to discover relationships between variables; therefore, the variables are not described as independent or dependent (Gall et. al, 2007). For this study, the variables were academic achievement, as measured by reading and math CRCT scores, and nutritional intake. The research was guided by the following questions:

1. Is there a relationship between the academic achievement of 8th grade students, as measured by the math CRCT scores, and their nutritional intake?
2. Is there a relationship between the academic achievement of 8th grade students, as measured by the reading CRCT scores, and their nutritional intake?

Research Hypotheses

The research hypotheses that guided this research follow:

1. $H_{1:}$ There is a statistically significant correlation between the academic achievement of 8th grade students, as measured by the math CRCT scores, and their nutritional intake.
2. $H_{2:}$ There is a statistically significant correlation between the academic achievement of 8th grade students, as measured by the reading CRCT scores, and their nutritional intake.

The null hypotheses that guided this research follow:

1. $H_{01:}$ There is no a statistically significant relationship between the academic achievement of 8th grade students, as measured by the math CRCT scores and their nutritional intake.
2. $H_{02:}$ There is no a statistically significant relationship between the academic achievement of 8th grade students, as measured by the reading CRCT scores and their nutritional intake.

Participants

The research population identified for this study included 8th grade students from a middle school in North Georgia. The students qualified to participate in this study if they were enrolled in the school when the CRCT was administered and purchased lunch from the school's cafeteria at least once per month from January to April. The students were selected through convenience sampling. Identifying students in the district of the semester increased the likelihood of having nutrition data available.

In educational settings, random sampling is often not feasible; therefore, the researcher used a convenience sample (Gall et al., 2007). Convenience sampling is often used because of its benefits, "or [researchers] face the possibility that they will be unable to do the study" (Gall et al., 2007, p. 175). A convenience sample was utilized to ensure a large enough sample size and sufficient power for the correlational analysis. To control for Type I and Type II errors, appropriate significance levels were chosen. The alpha level of the study refers to the level at which the null hypothesis will be rejected assuming that the null hypothesis is true. In social sciences, the alpha level is $p < .05$, which means there is a 5% margin of error in determining if a statistically significant relationship (Brace, Kemp, & Snelgar, 2009). A power analysis was conducted with G*Power 3.1 (Faul, Erfelder, Lang, & Buchner, 2007). For a medium effect size ($\rho = .30$), an alpha level of $p < .05$, and a power level of .80-.95, for a two-tailed test, the required sample size is 84-138 (see Figure 4).

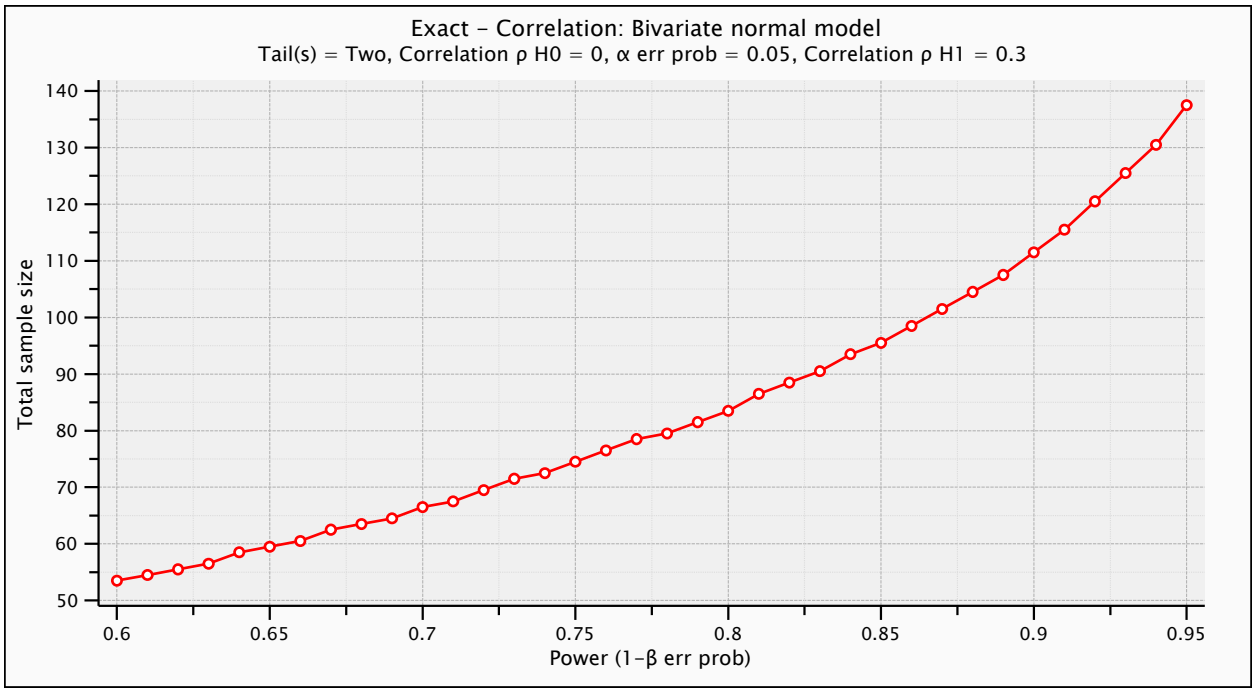

Figure 4. Power analysis

The sample included only eighth grade students enrolled in one North Georgia school who took the CRCT during the 2013-2014 academic school year. These students had purchased lunch from the school's café at least once per month from January to April of the same academic year. In all, of the total population, only respondents who meet the inclusion criteria were used in the sample.

Setting

The North Georgia school system used in this study has 19 middle schools. Approximately 44% of the students in this district are on free or reduced lunch. The school selected for this study consists of 1,045 students from diverse backgrounds. The ethnic backgrounds housed at this school include 4% Asian, 18% Black, 28% Hispanic, 5% multi-racial, and 44% White. Twenty percent of the population speaks a language other than English in the home, and more than 40% of the students are eligible for free or reduced lunches.

Instrumentation

The purpose of this correlation study was to determine whether there was a relationship between the academic achievement and the nutritional intake of students. The variables were academic achievement, as measured by reading and math CRCT scores, and nutritional intake. The instruments for this study were the CRCT and a nutritional intake daily journal report. The GaDOE testing and assessment department provides this instrument to Georgia schools annually. The CRCT was a standardized test used yearly in Georgia for grades three through eight to determine student achievement. The CRCT was used during the 2013-2014 school year. The CRCT set the minimum passing scaled score as 800. The cut scores were (a) Level 1 - below 800, do not meet the requirements; (b) Level 2 -800-849, meet requirements, and (c) Level 3 -

850 or above, exceed requirements. The math and reading portion of the CRCT was used to measure the knowledge and mastery of those subjects.

The GaDOE ensured that the CRCT was a valid and reliability instrument. Information about the validity and reliability of the CRCT is provided in *An Assessment and Accountability Brief* (GaDOE, 2013). The brief explained, "By attending carefully to each phase of the test development process, the GaDOE can ensure that the CRCT is a valid instrument" (GaDOE, 2013, p. 3). The GaDOE used a field test and a committee of Georgia educators to validate the questions and to review the field test items. Reliability information was reported by Cronbach's alpha reliability coefficient and the standard error of measurement (SEM) as a second statistical index. Cronbach's (alpha) is a statistical index used to estimate the reliability of a test. Cronbach's reliability coefficient "expresses the consistency of test scores as the ratio of true score variance to observe total score variance" (GaDOE, 2013, p. 4). The reliability indicators, 0.86 for Grade 8 Reading, and 0.92 for Grade 8 Math, obtained for the 2013 CRCT suggest that scores reported to students in 2013 are well estimated and provide a reliable picture of student performance (GaDOE, 2013).

The nutritional intake information and data were collected from the cafeteria manager. These data were exported from the one source nutrition database used at the school and submitted to the researcher in an Excel spreadsheet format. The data consist of the student's ID, the line where the student was served that day, and the date and time the meal was provided. Students who chose Line 3 or 4 were served a traditional lunch that had adequate calories with a federal required fruit and vegetable. Students who choose Line 2 were able to purchase a la carte meals consisting of unhealthier choices without federal regulations.

Procedures

After receiving approval from the dissertation committee and the local school administration, the proposal was sent to Liberty University's Institutional Review Board (IRB) for approval. Upon the required approval, the researcher contacted the cafeteria manager at the school for a daily journal report. The report included data for the entire school from January 2014 to April 2014. The end date was April, which was when the test was given. The spreadsheet contained the student's ID number, lane where food was purchased, the date, and time. This spreadsheet was then provided to the school's counselor. The nutritional intake was determined by the number of days healthy choices were made. The school's data support specialist provided the 2014 math and reading CRCT scores to the school's counselor. The data included the student ID number, 2013 math CRCT score, and 2013 reading CRCT score for every 8th grade student at the school. The counselor combined the nutritional intake and academic achievement data by the student's identification number. All data were reported to the researcher without identifying information. Outcome reports were reported as aggregated data.

Ethical Considerations

The researcher did not anticipate any great risk to the participants. The data used in this study were secondary and were not sensitive in nature. Names were not used and student ID numbers were removed before analysis to ensure privacy of participants. Further, because of the nature of the adolescent population of this study, the researcher completed the CITI training on research with children. All data collected will be kept on the researcher's password protected computer for three years. All corresponding notes will be kept in a locked file cabinet. After 3 years from publication, the researcher will shred all written documents related to the study. Any documents saved on the researcher's computer will be removed.

Data Analysis

Prior to combining the nutritional data with the academic data, the researcher had to determine the number of days each 8th grade student made healthy choices. The results of that data were then combined with the academic achievement, the math and reading CRCT scores, by student ID. The data were used to answer the following research questions.

Research Question 1: Is there a relationship between the academic achievement of 8th grade students, as measured by the math CRCT scores, and their nutritional intake?

Research Question 2: Is there a relationship between the academic achievement of 8th grade students, as measured by the reading CRCT scores, and their nutritional intake?

To answer both questions, the academic data were analyzed with the Pearson Product-Moment Correlation (Pearson's *r*) because the data were normally distributed. The Pearson correlation coefficient measures the strength of the linear relationship between normally distributed variables (Silverman, 2003). These data were screened for normality before the hypotheses were tested. Nutritional intake data were not normally distributed; therefore, the Spearman's rho was used to compute the correlation coefficient (Silverman, 2003). Stating that the data are normally distributed means that it follows a symmetrical bell-shaped curve. The Spearman's rho is a statistical test that measures the correlation between two variables based on their rankings. Table 1 provides the variables of interest and scales of measurement for the study.

Table 1

Variables of Interest, Predictor Variable, Criterion Variable, and Scales of Measurement

Hypothesis	Predictor Variable/Scale of Measurement	Criterion Variable/Scale of Measurement
$H_{1:}$ There is a statistically significant relationship between the academic achievement of 8th grade students, as measured by the math CRCT scores, and their nutritional intake.	Nutritional intake: Interval	Academic achievement in Math: Interval
$H_{2:}$ There is a statistically significant relationship between the academic achievement of 8th grade students, as measured by the reading CRCT scores, and their nutritional intake.	Nutritional intake: Interval	Academic achievement in Reading: Interval

Summary

This chapter provided a detailed description of the procedures, research design, and process. The sample population was defined and data explained. Further, the instrumentation for the study, the method of data collection, and the process of data analysis were described. In addition, this chapter addressed the ethical considerations for the study.

CHAPTER FOUR: FINDINGS

Research Questions

The purpose of this correlation study was to determine whether there was a relationship between the academic achievement and the nutritional intake of students. This research was guided by the following research questions:

1. Is there a relationship between the academic achievement of 8th grade students, as measured by the math CRCT scores, and their nutritional intake?
2. Is there a relationship between the academic achievement of 8th grade students, as measured by the reading CRCT scores, and their nutritional intake?

Research Hypotheses

The research hypotheses that guided this research follow:

1. $H_{1:}$ There is a statistically significant correlation between the academic achievement of 8th grade students, as measured by the math CRCT scores, and their nutritional intake.
2. $H_{2:}$ There is a statistically significant correlation between the academic achievement of 8th grade students, as measured by the reading CRCT scores, and their nutritional intake.

The null hypotheses that guided this research follow:

1. $H_{01:}$ There is no a statistically significant relationship between the academic achievement of 8th grade students, as measured by the math CRCT scores and their nutritional intake.
2. $H_{02:}$ There is no a statistically significant relationship between the academic achievement of 8th grade students, as measured by the reading CRCT scores and their nutritional intake.

Descriptive Statistics

Data obtained for the predictor variables included the daily nutritional guide obtained from the school's cafeterias once source nutrition database. Reading and math subtests from the Georgia Criterion-Reference Test (CRCT) were used for academic achievement for the criterion variable. Performance levels for all subtest are indicated as Does Not Meet Standard (scale score below 800), Meets Standard (scale score 800 – 840), or Exceeds Standard (scale score above 850).

In all, 363 students comprised of the total population. Complete data were provided on 347 students. The 16 student not included did not meet the inclusion criteria of taking the CRCT in math and reading during the 2013-2014 academic school year and purchased lunch from the school's café at least once per month from January to April of the same academic year.

Based on the CRCT-mathematics achievement, 15.3% (n = 53) did not meet the minimum passing scaled score of 800; 42.9% (n = 149) exceeded the requirements scoring above 850; and 41.8% (n = 145) met the requirements scoring between 800 and 849 (see Figure 5).

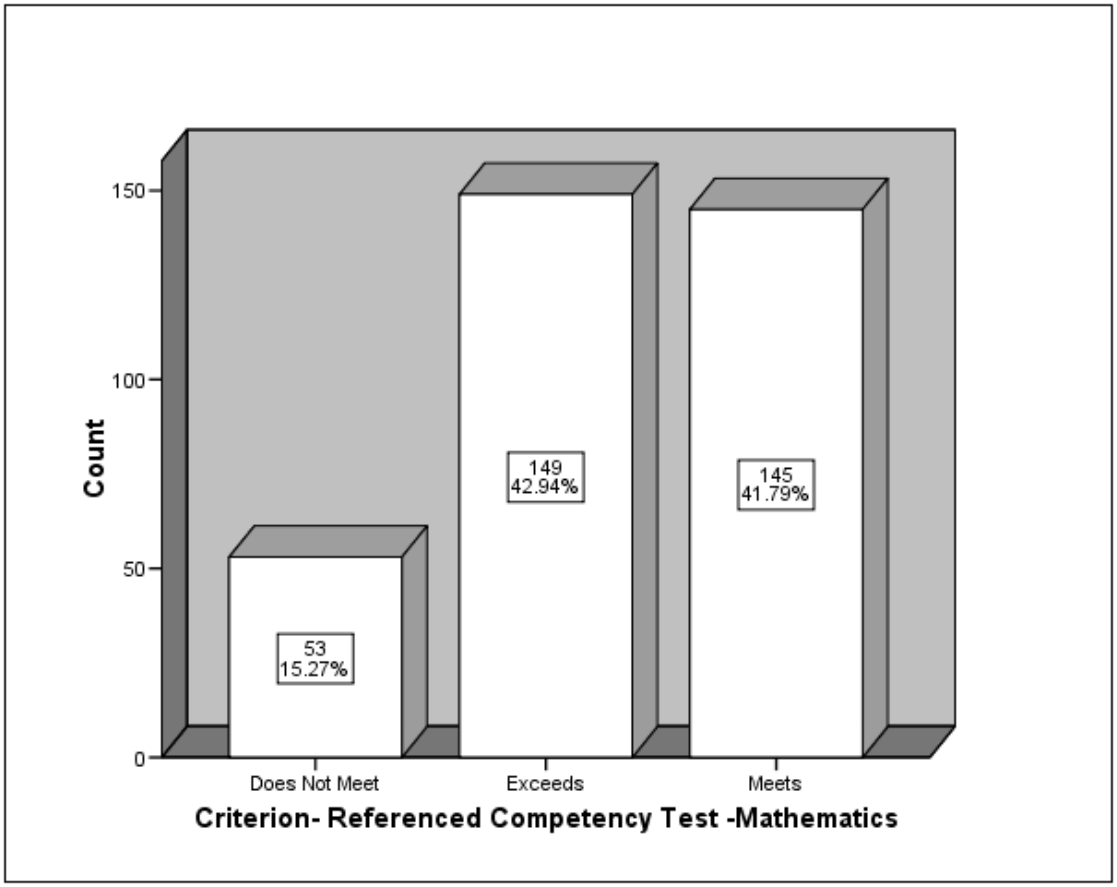

Figure 5. Criterion-Referenced Competency Test- mathematics

Based on the CRCT- reading achievement, 2% (*n* = 7) did not meet the minimum passing scaled score of 800; 63.4% (*n* = 220) exceeded the requirements scoring above 850; and 34.6% (*n* = 120) met the requirements scoring between 800 and 849 (see Figure 6).

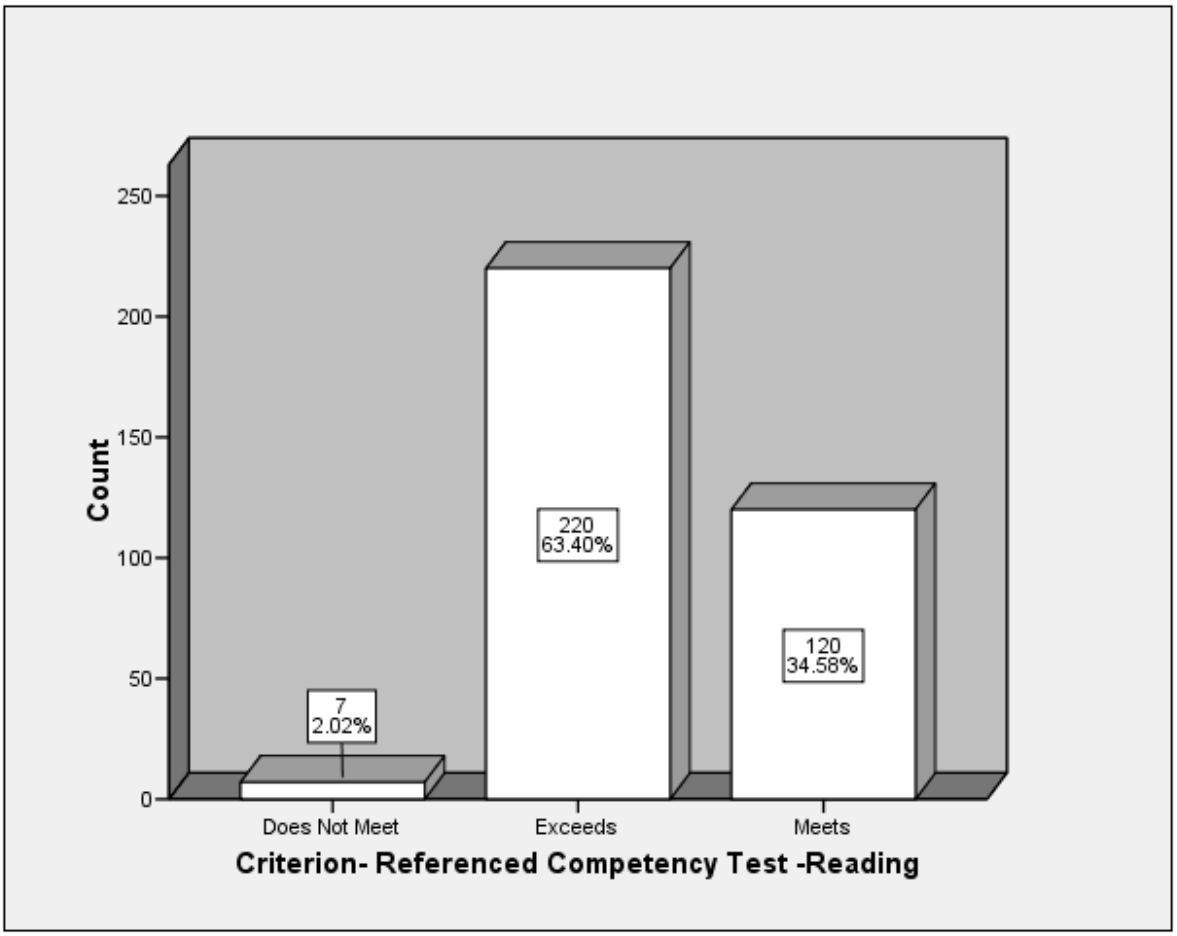

Figure 6. Criterion-Referenced Competency Test- reading

The actual math scores ranged from 753 to 990 (M = 843.91, SD = 47.72). Reading scores ranged from 779 to 920 (M = 855.01, SD = 29.63). Regarding nutritional intake, students selected nutritious meals 0 to 57 days (M = 13.35, SD = 17.38) from January to April during the 2013-2014 school year.

Results

Data Screening

Data were screened for normality with skewness, kurtosis statistics, and histograms. In SPSS, if the absolute values of the skewness and kurtosis coefficients are less than two times the standard error, the distributions are considered approximately normal. Based on these criteria, the distributions for math score and nutritional intake were significantly positively skewed, whereas the distribution for reading score approximated normality (see Table 2).

Table 2

Skewness and Kurtosis Coefficients

	N	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
Math Scores	347	.645	.131	.194	.261
Read Scores	347	.209	.131	-.106	.261
Nutritional Intake	347	.807	.131	-1.051	.261

The histogram for math score, however, appeared to be a normal distribution. Figure 7 provides an illustration of the distribution.

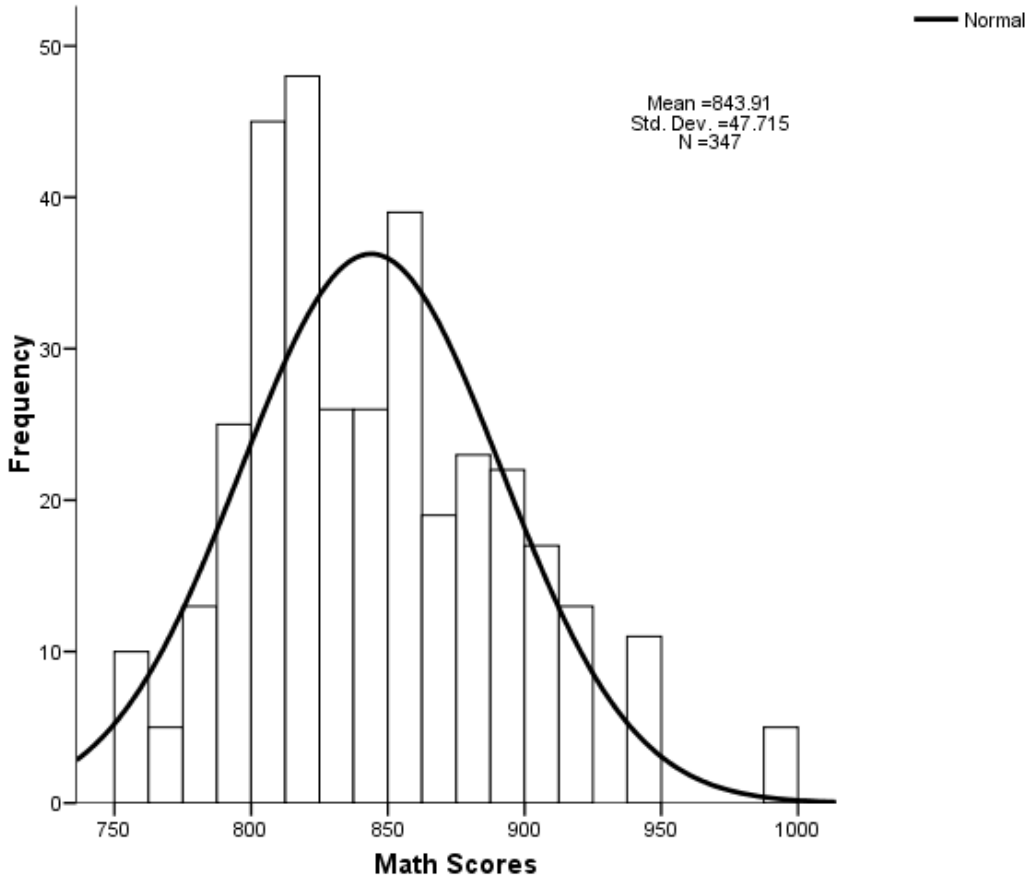

Figure 7. Histogram for math scores

According to the mathematical criteria, the distribution for reading scores was normally distributed. The histogram for reading scores is illustrated in Figure 8.

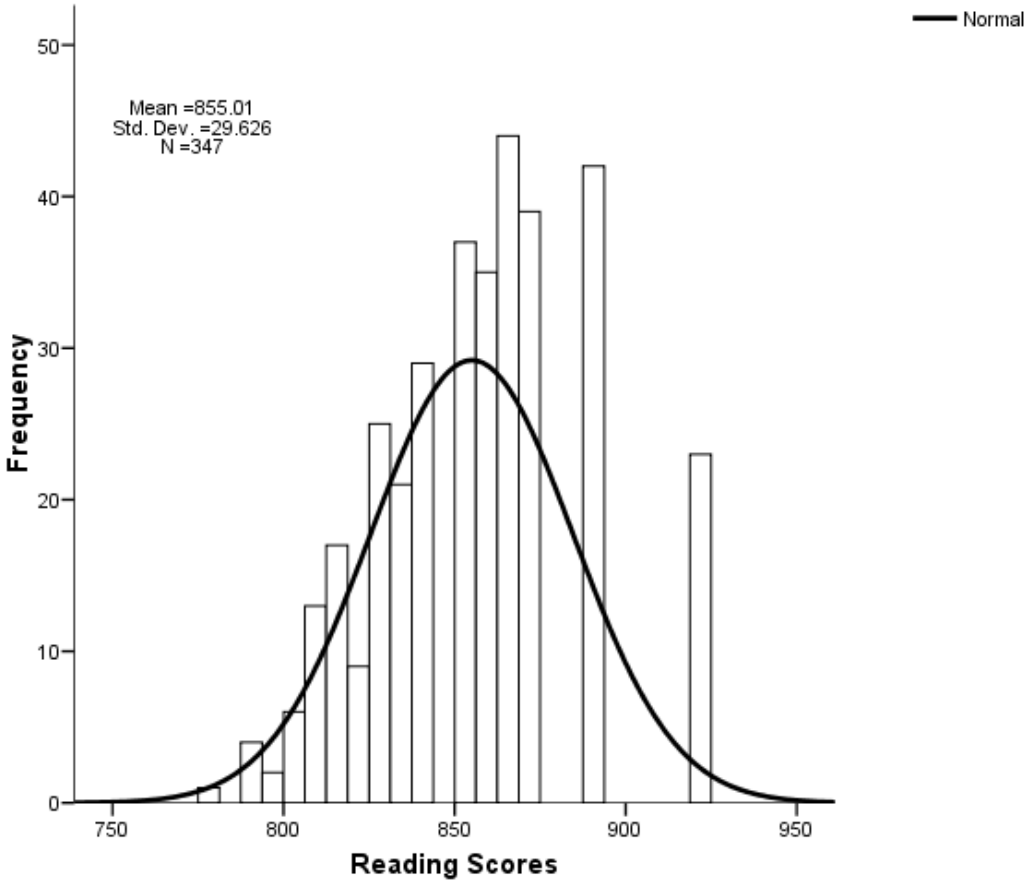

Figure 8. Histogram for reading scores

The distribution for nutritional intake had a significant positive skew and was platykurtic, which means that it was flatter than a normal distribution. The histogram for nutritional intake is illustrated in Figure 9.

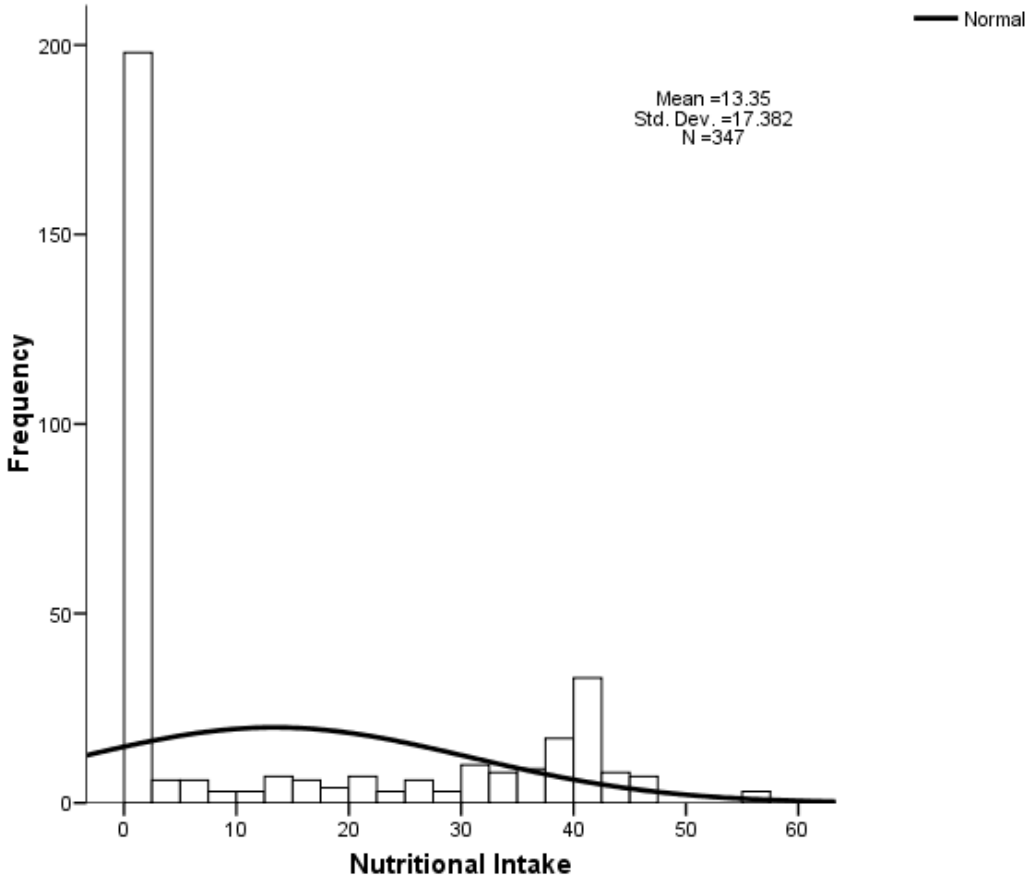

Figure 9. Histogram for nutritional intake

Because some distributions were normal and some were not, the Pearson *r* and the Spearman's rho were both used to answer the research questions and hypotheses.

Hypothesis One

Is there a relationship between the academic achievement of 8th grade students, as measured by the math CRCT scores, and their nutritional intake? There was a significant, negative relationship between math CRCT scores and nutritional intake, $r\ (345) = -.41$, $p < .001$, two-tails. As nutritional intake increased, there was a corresponding decrease in math CRCT

scores. The coefficient of determination (r^2) = .1681, which means that 16.81% of the variance in math scores can be explained by nutritional intake. A scatterplot of this relationship is illustrated in Figure 10.

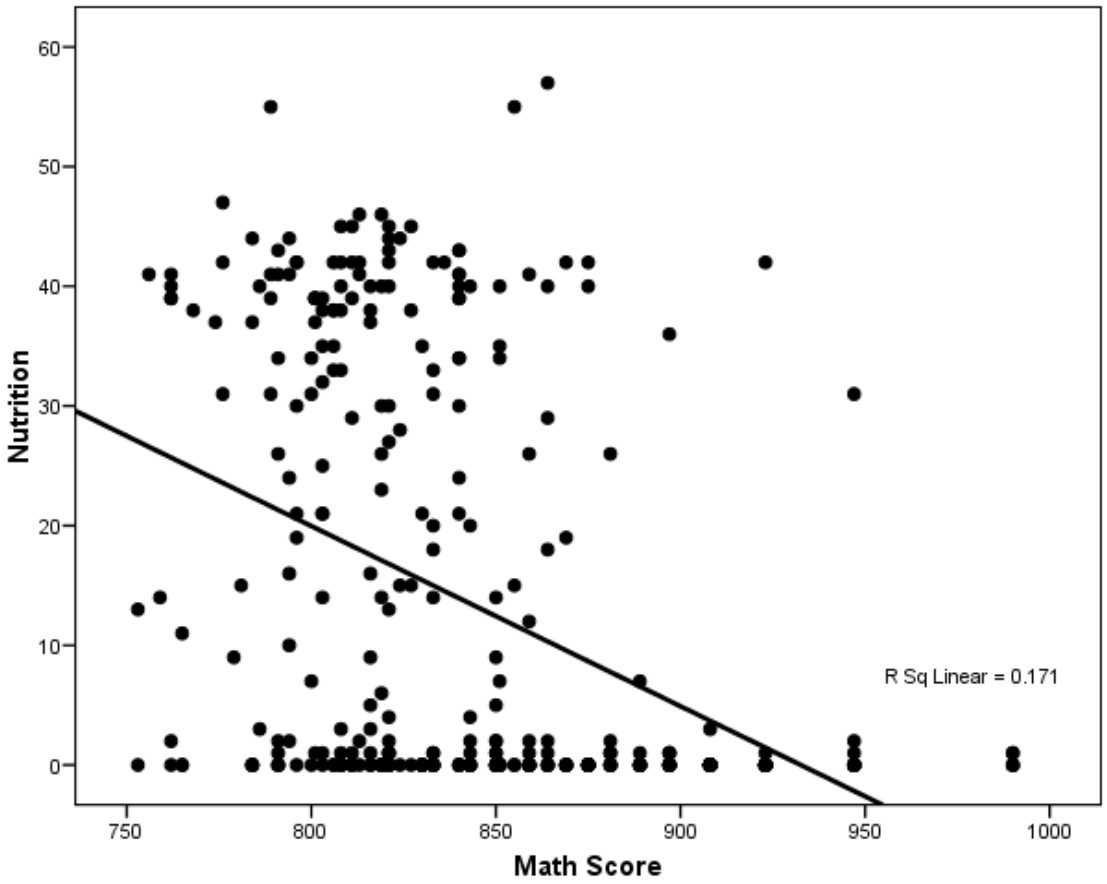

Figure 10. Math scores and nutritional intake

Spearman rho results were similar to the Pearson r results in that there was a significant negative relationship between math CRCT scores and nutritional intake, $r_s = -.46$, $p < .001$, two-tails. H_{01} stated that there is no a statistically significant relationship between the academic achievement of 8th grade students, as measured by the math CRCT scores and their nutritional intake. There was a significant, negative relationship between math CRCT scores and nutritional intake, $r(345) = -.41$, $p < .001$, two-tails. Therefore, the null hypothesis was rejected.

Hypothesis Two

Is there a relationship between the academic achievement of 8th grade students, as measured by the reading CRCT scores, and their nutritional intake? There was a significant, negative relationship between reading CRCT scores and nutritional intake, $r(345) = -.39$, $p < .001$, two-tails. As nutritional intake increased, there was a corresponding decrease in Reading CRCT scores. The coefficient of determination (r^2) = .1521, which means that 15.21% of the variance in reading scores can be explained by nutritional intake. A scatterplot of this relationship is illustrated in Figure 11.

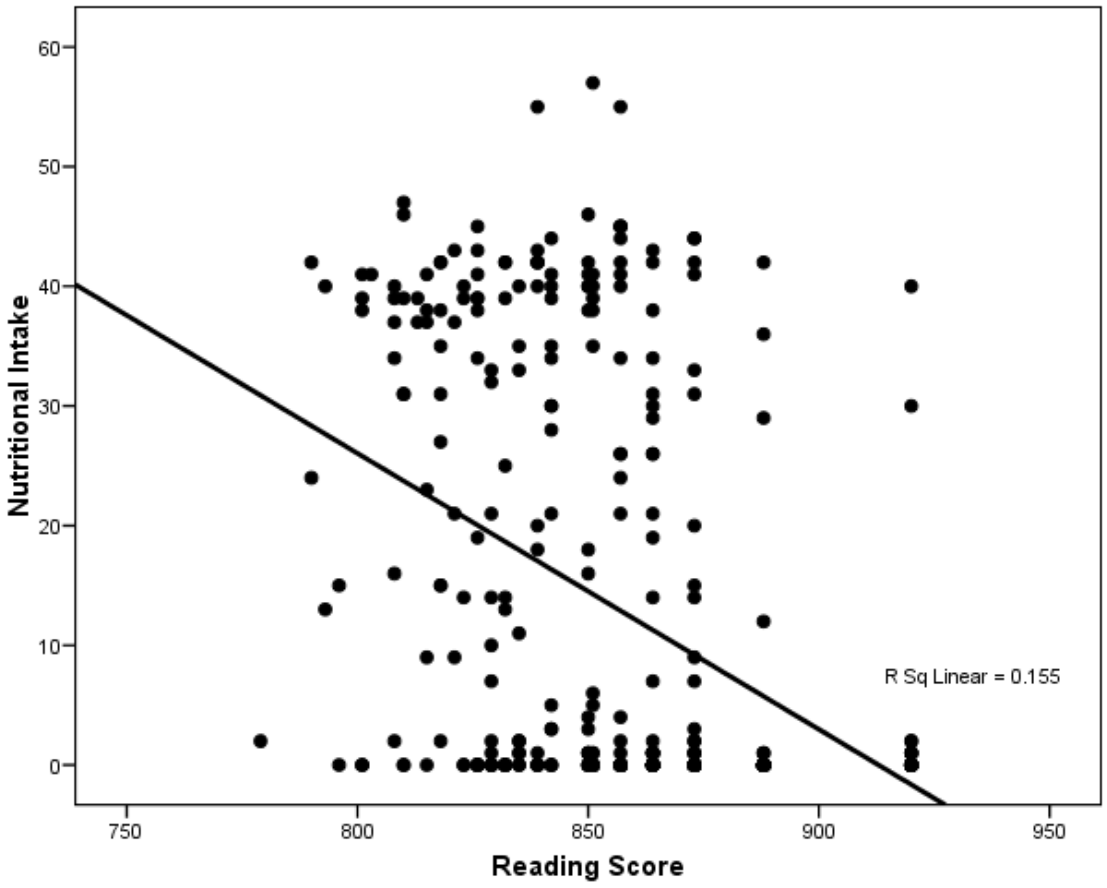

Figure 11. Reading scores and nutritional intake

Spearman rho results were similar to the Pearson *r* results in that there was a significant negative relationship between reading CRCT scores and nutritional intake, $r_s = -.43$, $p < .001$, two-tails.

H_{02} stated that there is no a statistically significant relationship between the academic achievement of 8th grade students, as measured by the reading CRCT scores and their nutritional intake. There was a significant, negative relationship between reading CRCT scores and nutritional intake, $r(345) = -.39$, $p < .001$, two-tails. Therefore, the null hypothesis was rejected.

Summary

Two research questions and hypotheses were formulated for investigation. Both alternative hypotheses were supported by the Pearson *r* and Spearman's rho. There was a significant, negative relationship between math CRCT scores and nutritional intake. There was also a significant, negative relationship between reading CRCT scores and nutritional intake. Chapter 4 presented the findings of the academic and nutritional data. The implications of the findings will be discussed in Chapter Five.

CHAPTER FIVE: DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

Chapter 5 is the last chapter of this study and includes the findings, implications, limitations, and recommendations for future research on relationship between the academic achievements. The nutritional intake of students was determined by the number of days a traditional lunch was chosen, which usually more healthy choices. The chapter consists of discussions, conclusions, implications, limitations of the study, and recommendations for future research.

The purpose of this correlation study was to determine whether there is a relationship between the academic achievement and the nutritional intake of students. The variables of interest were academic achievement, as measured by reading and math Criterion- Referenced Competency Test (CRCT) scores and nutritional intake. The findings of this study may help administrators, teachers, and parents understand whether a relationship exists between nutritional intake and academic achievement. This study may provide stakeholders with the evidence to emphasize the importance of proper nutrition toe the achievement gap.

The participants included only eighth grade students enrolled in this North Georgia school and took the CRCT during the 2013-2014 academic school year. These students also must have purchased lunch from the school's cafeteria at least once per month from January to April of the same academic year. There are 365 students in the total population; however, only 347 respondents who meet the inclusion criteria were used in the sample, which represents a 96% response rate.

Discussion

This study addressed two null hypotheses with the following results: $H_{01:}$ There is no a statistically significant relationship between the academic achievement of 8th grade students, as measured by the math CRCT scores and their nutritional intake. The null hypothesis was rejected because nutritional intake was statistically significant predictor of math CRCT scores. As nutritional intake increased, there was a corresponding decrease in math CRCT scores, which indicated a negative relationship between math CRCT scores and nutritional intake.

$H_{02:}$ There is no a statistically significant relationship between the academic achievement of 8th grade students, as measured by the reading CRCT scores and their nutritional intake. The null hypothesis was rejected because the nutritional intake was statistically significant predictor of reading CRCT scores. As nutritional intake increased, there was a corresponding decrease in reading CRCT scores, which indicated a negative relationship between reading CRCT scores and nutritional intake. The results of the study demonstrated that a significant relationship existed between nutritional intake and academic achievement for eighth grade middle school students in north Georgia schools.

Nutritional Intake and Academic Achievement

Nutrition has affected student achievement since 1906, when poverty caused students not to learn because of a weak condition (Pimpare, 2011). The National School Act was amended in 2006 to introduce new fresh fruits and vegetables to school age children. Finally, in 2010, the Healthy, Hunger Free Kids Act was enacted by President Obama to help raise healthier children by aligning meals to nutrition (Stallings & Taylor, 2008). Burkhalter and Hillman (2011) also found that individuals aged 19-33 showed improved attentiveness and motivation after consuming a well-balanced meal.

Several research studies linked student's dietary intake with their ability to learn (Benton & Roberts, 1988; Taras, 2005). The dietary intake of previous studies measures the calorie intake, the amount of a specific vitamin, or supplement. This study used the nutritional intake based on the major food groups as described by the USDA. In both the United States and the United Kingdom, experimental studies have investigated how multivitamin and mineral supplements affect school age children's academic performance (Nelson et al., 1990; Schoenthaler et al., 2000). In the United States, a few studies indicated that an iron deficiency can negatively affect math achievement, and breakfast can positively affect cognitive skills (Bruner et al., 1996; Pollitt, 1997). In several countries, researchers have associated undernourished school-age children with diminished academic achievement (Alaimo et al., 2001; Hall et. al, 2001; Ivanovic et al., 1996).

This study found that nutritional intake was a statistically significant predictor of academic achievement in both math and reading. These findings support prior research that nutritional intake correlates with academic achievement; however, they are inconsistent in the direction. Mukudi (2003) conducted a correlation study to examine the effects of the nutrition status of eighth-grade school achievement scores in Kenya. The results in Mukudi's study showed students who were better nourished perform significantly better in school. The results indicated that achievement scores varied by schools, which were divided by socioeconomic status. In Shilts et al.'s (2009) quasi-experiential study, the findings suggest that increasing the consumption on breakfast, decreasing iron deficiency, and obesity can further academic achievement.

This correlation study was built upon the research conducted by three theories: Maslow's hierarchy of needs, Pollitt's undernourished child, and Jensen's teaching with the brain in mind.

Maslow's theory of basic needs organized human needs in to five general categories: (a) physiological needs, (b) safety needs, (c) belongingness needs, (d) esteem needs, and (e) self-actualization. The most predominate needs in the hierarchy are the physiological needs because they represent the requirements for physical survival such as oxygen, food, liquid, shelter, and sleep (Seeley, 1992). The lower needs of physiological and safety must be satisfied before moving to the higher level needs (Gambrel & Cianci, 2003). These results identify with Maslow's theory. When the basic need of food is met, students are able to move on to the next hierarchy of needs. Pollitt (1993) documented that children with iron deficiencies perform lower on intelligence test and cognitive processes than iron sufficient children. Pollitt's theory also discussed the influence of under nutrition on intellectual activities such as thinking, reasoning, and remembering (Bryan et. al, 2004). Jensen's theory explained that the right food could boost learning memory and intelligence (Jenson, 2008).

The results of this study indicate that a healthy nutritional intake negatively influenced academic achievement. The findings of this research study were inconsistent with both Pollitt's and Jenson's theories. Although this findings of this study show a statistically significant correlation between the academic achievement and nutritional intake, this study's finding show a negative relationship. This would indicate that providing the basic need of food regardless of the nutritional value could improve academic achievement. However, the results identify with Maslow's theory of hierarchy. Maslow's theory suggests that when a basic need of food is met, then students move to higher level of needs, such as self-esteem.

Conclusions

This research study examined the relationship between nutritional intake and student academic achievement, as measured by reading and math scores on the Georgia CRCT of 8th grade students. The primary purpose of this quantitative study was to examine if a correlation existed between nutritional intake and academic achievement. Students in the 8th grade who took the CRCT during the 2013-2014 academic school year, and purchased a lunch from the cafeteria at least once from January to April of the same academic year were included in the study.

This quantitative study sought to answer the two research questions guiding this investigation. The findings from this research indicated that both hypotheses were supported by the Pearson *r* and Spearman's rho. There was a significant, negative relationship between math CRCT scores and nutritional intake. There was also a significant, negative relationship between reading CRCT scores and nutritional intake.

The literature review included the theoretical foundation of nutrition and academic achievement, and the theories of physiological, cognitive based learning and academic achievement. The research also reviewed literature and studies regarding academic achievement, nutrition, and nutrition and learning. Based on the review of literature, academic achievement, proper nutrition, and growth development have been a concern for many years. Federal, state, and local schools have worked diligently to develop ways to close the achievement gap and increase student academic performance.

The literature showed the importance of having a well-balanced meal. Studies revealed that skipping breakfast could have a negative effect on class performance. According to the literature, low class performance is noticed more in students poorly nourished or deficient in iron

or other important supplements. To improve the nutritional intake, the NSLP offered free or reduced lunch and breakfast to students who qualified. In a study done in Kenya by Mukudi (2003), it was found that adequate nutrition was evident in the association of higher achievement among students in higher income school categories.

Previous research on nutrition indicated the importance of a healthy diet on cognitive development. Therefore, it is important for more research to be conducted so a stronger understanding of specific influences of nutritional intake can be understood. As future research is conducted, schools may identify the results of a healthy diet with academic achievement. The outcomes of this and future studies may provide school administrators and stakeholders with a clearer understanding of the relationships between nutrition and academic achievement. The results may be meaningful to cafeteria managers, district nutrition specialists, parents, teachers, administrators, and legislators. When the school stakeholders see a change in behavior or academic achievement, they may be more willing to implement healthier school lunch programs.

Implications

In this study, a negative correlation was found between nutritional intake and academic achievement as measured by scores on the Georgia CRCT in the areas of reading and math. The implication suggested that students with lower nutritional intake perform better academically. Woodhouse and Mark (2012) stated, "Great academic performance cannot be expected from students experiencing basic needs deprivation" (p. 3). Maslow's hierarchy of basic need theory explains why nutrition is a basic physiological need required for physical well-being (Poston, 2009). As the primary needs become satisfied, the next level of need is activated. Therefore, once physiological needs are met, a student can move to the next level of the hierarchy. This

could indicate that providing the basic need of food regardless of the nutritional value can improve academic achievement.

Another implication this study is that the school cafeteria's traditional lunch may not provide the nutrition value expected from the federal government. Exposure to poor nutrition negatively affects student's academic achievement and cognitive abilities (Basch, 2011). Giving middle school students the option of a traditional or al a carte lunch in the cafeteria during 2013 - 2014 school, made it difficult to track the daily consumption of healthy foods. In 2015, the ala carte line closed and students were forced to buy traditional lunch, snacks, or bring a lunch from home. This change in the county's policy helped encourage students to eat a healthier meal during lunch. In addition, the daily nutritional journal used to determine the nutritional intake, nutrition assessments, or surveys may be used by educators to help students choose meals that are more nutritious. To understand the correlation between nutrition intake and academic achievement, future research should examine the nutrition intake of a student for the entire day.

The results of this study indicated that as nutritional intake increased the academic achievement decreased. This could indicate the need for additional variables, such as socioeconomic level. The nutritional intake report provided by the cafeteria manager revealed students who purchased food from the cafeteria, which were in the sample, were on a lower socioeconomic level. This observation was determined because the meal dollar amount was at a reduced rate or free. The lack of students in the sample from the higher socioeconomic status who purchased lunch daily could have caused a negative impact on the academic achievement. This study and previous studies suggest that further research is needed to expand the knowledge of this research topic.

Limitations

The researcher identified a few limitations to the study.

1. The researcher assumed that academic honesty was maintained by the students when taking the CRCT, and teachers when distributing the test materials. Further, the researcher assumed that the test was administered with consistency and similar techniques.
2. This study was limited to 8th grade students in a Georgia middle school; therefore, because of a specific population of the sample, generalization would be difficult. It cannot be determined if the nutritional intake will affect other states' schools.
3. This study was also limited in randomization. Students' academic achievement, as measured in this study, was determined by the CRCT at the end of the school year; therefore, students who attended schools out of the district during the 2013-2014 CRCT administration were not included.
4. The daily nutrition report provided information on the purchase; however, it was assumed that the student ate the lunch.
5. A different population may produce different results.
6. Students with special education accommodations were not disaggregated; some may have received accommodations on the CRCT.

Recommendations for Future Research

This study is important because of the absence of empirical research available on the actual relationship between nutritional intake and academic achievement for students. This research provides an understanding of the importance of nutritional intake on the academic

achievement of students. Future studies should seek to provide additional information on nutrition and achievement.

The current study included only 8th grade students from one North Georgia middle school. Further research should utilize a randomly selected population of 6th, 7th, and 8th grade students. Increasing the sample size would also increase the statistical significance and it will ensure a broader generalizability. In addition, the current study involved the comparison of two co-variables, which were academic achievement and nutritional intake. Future research on this topic may consider additional variables such as gender, age, and ethic group. The results will help breakdown responses into meaningful groups to see how closely the sample replicates the population of the school. In addition, the analysis of subgroups will show more information than the aggregate data.

This study was performed using archival data to ensure accurate information for academic achievement and nutritional intake. Data for nutritional intake were provided from a daily journal report. The report included the lane where food was purchased: ala cart lane or traditional lane. The traditional lane was considered the healthier choice. The nutritional intake was determined by the number of days healthy choices were purchased. To address these limitations, future research should incorporate daily logs or surveys to ensure accurate reporting of healthy nutritional intake.

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