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The Relationship Between Middle School Lexile Growth and School Nutrition

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THE RELATIONSHIP BETWEEN MIDDLE SCHOOL LEXILE GROWTH AND SCHOOL NUTRITION

by

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(Under the Direction of Teri Denlea Melton)

ABSTRACT

Children in poverty tend to have malnutrition and iron deficiency, and often receive their only meals for the day from a school nutrition program. Students of poverty are often malnourished. Nutrition deficiencies during the adolescent years may increase the risk of decreased cognitive function. Research has found that iron can have a positive impact on brain health. School breakfast and lunch programs follow USDA guideline that limit portions, fats, salts, and sugars, but do not fortify vitamin and minerals necessary to impact brain health. One middle school in Southeast Georgia implemented Kotter's Eight Stage Process to Creating a Major Change to improve the school's nutrition program and address the needs of the low socioeconomic student population. This study analyzed the effects of an iron-rich school nutrition program on student Lexile growth. Lexile data were collect from the 2016 and 2017 Georgia End of Grade English language arts Assessment. The findings resulted in a significant increase (M = 104.31) in Lexile growth for all students (n = 189) controlling for low socioeconomic status. This research brings to focus the unexplored wide spread approach to using school nutrition programs to address the middle school student nutritional requirements for brain health.

INDEX WORDS: Educational Leadership, Nutrition, Lexile growth, Poverty, Middle grades education

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DEDICATION

I would like to dedicate this dissertation in loving memory of Margaret Lillian Blount. Mrs. Blount was my husband's grandmother, an elementary school cafeteria manager for over 30 years, and a wonderful woman who enjoyed serving people good food.

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CHAPTER 1

INTRODUCTION

It is likely that the academic interventions that schools are providing to students of poverty are being delivered to unhealthy brains. It is also quite possible that one answer to improving student achievement could reside in addressing the food served in the school cafeteria. The National Center of Education 2016 Statistics reports that dropout rates have decreased over the last five years, but students in the lowest income quartile continue to drop out at higher rates than students in higher income quartiles. Achievement gaps between low socioeconomic students and their peers is an education crisis. Current interventions to increase academic performance for students of poverty have failed to make a widespread impact on achievement and graduation rates. Scholarships, community programs, and mentors are only helping a small portion of the population. This research brings to focus the unexplored widespread approach to using school nutrition programs to address the middle school student nutritional requirements for brain health.

Research has shown that nutrition affects cognitive function. Outside organizations have found a connection to increasing iron in children's diets to improvements in attendance, school progress, and IQ scores. Educational systems promote nutrition and physical education. However, the two agencies have not connected on the same goal of improving student achievement. United States Department of Agriculture requirements for school nutrition programs focus on what not to give children, instead of what should be provided for brain health (Story & Stang, 2005). Educational leaders have a moral obligation to promote health and social justice for all students. Therefore, the purpose of this study was to determine if an intervention in terms of an iron-rich school menu can increase academic achievement and, thus, level the playing field for student health and student achievement through school nutrition programs.

Melton Middle School (MMS; a pseudonym) is a rural school in southeast Georgia, serving approximately 620 sixth, seventh, and eighth grade students. MMS is a Title I school with 60% (374 students) low socioeconomic status (SES) students eligible for free and reduced lunch. The school Food and Nutrition staff feeds 72% (428) of the school's student's breakfast and 87% (520) of the school's student's lunch. One hundred percent of the low socioeconomic status students eat breakfast and lunch at school. Research has shown that food and beverages consumed at school contribute to an average of 35% to 51% of the total dietary intake of children and adolescents (Lucarelli, et al., 2014). For students from low-income families the percentage can be much higher. Research also showed that in a typical school day, 25% of the calories consumed by American children comes from low nutrient, high calorie food or beverages (Lucarelli, et al., 2014).

The school has developed, implemented, and promoted a new iron rich menu for the students. The researcher used a correlational research design to collect data from the Georgia Milestone End of Grade Assessment from the Georgia Department of Education Administrative portal. A Lexile score is given in connection to performance on the English language arts portion of the assessment. The researcher determined Lexile growth over three waves of data for a sample of eighth grade students using archived data from grades sixth and seventh, looking also at socioeconomic status and gender subsets.

The significance of this study was to inform schools and districts in efforts to reduce inequalities in both academic achievement and students' health.

Sufficient nutrition is necessary for average brain health. The United States Department of Agriculture (USDA) requires schools to regulate calories, saturated fat, and sodium in school lunch menus. Sufficient nutrition is necessary for average brain health. Nutrition is especially important for children in early growth and development, which are critical times for building the basis for cognitive, motor, and socioemotional skills throughout childhood and adulthood. Iron supplements for anemic school children in other countries has shown improved cognitive performance and intelligence scores. Before addressing the school nutrition offerings, only seven out of 131 items available for the MMS Food and Nutrition staff to build the schools breakfast and lunch menus contained half of the recommended daily intake of iron, the other items contain far less or no iron at all. According to the Guidelines for Adolescent Nutrition Services, children ages 9 -13 years of age should consume 8 milligrams a day (mg/d) of iron; by ages 14-18 years the recommended daily intake increases to 11 mg/d for males and 15 mg/d for females (Story & Stang, 2005). According to the World Health Organization, iron deficiency is the most prevalent single nutrient deficiency and affects both developed and developing countries (Murray-Kolb & Beard, 2007). Infants, children, and menstruating females are at the highest risk for iron deficiency anemia.

Historically, the low socioeconomic population at MMS has performed poorly on the state mandated tests in all content areas. Unfortunately, economically disadvantaged students are expected to perform at the same levels as other subgroups. However, research shows students of poverty are not as healthy as their school peers which impacts student achievement. Iron deficiency has been shown to impair cognitive abilities even in the absence of overt anemia in adolescents. Iron supplements provided to anemic school children has resulted in improved cognitive performance and intelligence scores (Murray-Kolb & Beard, 2007). Based on the academic performance of low socioeconomic status students at MMS and the research concerning iron deficiency and cognitive function, the change in school nutrition program should be examined. The researcher sought to identify the relationship between a school nutrition program and academic achievement to inform efforts to reduce inequalities in both academic achievement and student health. Given the struggles required to make school policy changes, research is needed to test the idea that promoting student health will also support academic achievement (Ickovics, Carroll-Scott, Schwartz, Gilstad-Hayden, & McCaslin, 2014). It is the responsibility of the school leader to explore multiple methods to improve achievement for all students.

Proper nutrition is important to brain health. The brain of a teenager continues to grow and develop during adolescence. Cognitive pathways are reorganized and strengthened during middle and high school. School food and beverages make up 35% to 51% of total dietary intake of children (Lucarelli, et al., 2014). However, school food programs do not regulate micro or macronutrients such as iron: rather, schools are required to regulate calories, saturated fat, and salt. According to the Guidelines of Adolescent Nutrition Services, teens need up to 11 milligrams a day of iron and menstruating females require as much as 15 milligrams a days (Story & Stang, 2005). Unfortunately, school nutrition programs offer less than half of the daily requirement of iron. Therefore, schools may not be providing the nutrients required for brain health. For this reason the school has developed, implemented, and promoted a new iron rich menu for the students.

The U.S. middle class is currently shrinking (Mather & Jarosz, 2014). Poverty was once thought of as a condition of African-Americans, Hispanics, and Native Americans. However, from a collective view, there are more Whites below the poverty line than African-Americans; 20 million Whites compared to 9 million African Americans. However, from a percentage standpoint, 25% of African Americans live below the poverty line as compared to only 10% of Whites. Current trends in poverty present major economic gaps. Measures of income inequality can depend on where you live. The highest income inequality exists in California and parts of the Northeast and South with lower income inequality in Midwest and Mountain West. The 2013 Gini Index reported Georgia as one of eight states with higher income inequality than the national average (Mather & Jarosz, 2014). Changes in racial composition, family composition, and age structure are linked to the rising income inequality. Education is the primary factor that separates those at the top and those at the bottom of the income gap (Jenson, 2009). The 2013 Gini Index has suggested that the groups at the bottom of the income distribution make up a growing population and that poverty levels are expected to increase. Rising poverty levels have reduced opportunities for millions of children compared to previous generations.

Focusing on the early development of children through the prevention of nutrient deficiencies may have long-term and widespread benefits for individuals and societies (Prado & Dewey, 2014); globally, 58% of children suffer from iron deficiency. Reproductive, maternal, newborn, and child health (RMNCH) interventions eventually precluded macro and micronutrient deficiencies. The following interventions are examples of strategies that have been found to be effective in preventing nutrient deficiencies: salt iodization to prevent iodine deficiency, iron fortification to prevent iron deficiency anemia, and educational interventions that emphasize nutrient rich animal source foods, in combination with food supplementation in food-insecure populations. These types of interventions are important to counterbalance the negative effects of opposing environmental conditions (poverty and low maternal education) that often coincide in populations in which undernourishment is common (Prado & Dewey, 2014). Macro and micronutrient supplementation, disease prevention, and treatment during pregnancy has shown to increase birthweight. When children of normal height and weight start school on time, they progress through the curriculum on schedule and have higher academic achievement. Worldwide RMNCH interventions appear to have a greater financial return compared to other poverty alleviation programs in developing and developed countries (Halim, Spielman, & Larson, 2015). The research indicated that an investment in nutrition is also an investment in brain health that could possibly lead to a return to national financial stability.

Few studies have examined the influence of macronutrient health on educational outcomes, even though it is widely recognized that minerals are critical to neurocognitive development (Douong, Mora-Plazas, Marin, & Villamor, 2015). Iron supplements for anemic school children in other countries has shown improved cognitive performance and intelligence scores. Vitamin B-12 supplements provided to Kenyan school children was positively related to memory test scores in the Douong 2015 prospective study. A cross-sectional National Health and Nutrition Examination Survey in the United States found that serum folate but not vitamin B-12 concentrations were related to improving reading scores in children aged 6-16 years (Douong, Mora-Plazas, Marin, & Villamor, 2015). The World Health Organization (WHO) estimates that worldwide, 2 billion people are anemic and twice as many are iron deficient (ID). Because of their greater physical requirements, combined with poor diet, those at the highest risk of developing ID and IDA are infants, children, and women of reproductive age. Non-blood disorders related ID include physical endurance, an impaired immune system, difficulty regulating temperature, changes in metabolism, decreased cognitive functioning, and behavioral disturbance. In adolescents, ID has been shown to impair cognitive abilities even in the absence of overt anemia (Murray-Kolb & Beard, 2007).

Sufficient nutrition is necessary for average brain health. Nutrition is especially important for children in early growth and development, which are critical times for building the basis for cognitive, motor, and socioemotional skills throughout childhood and adulthood. Some maturing of neural pathways depends on input from the child's environment. Adequate nutrition is an aspect of the environment and important to normal brain development. Poor nutrition is more likely to harm brain development if the deficiency occurs during a time period when neural development is high (Prado & Dewey, 2014). The adolescent brain is undergoing an important developmental reorganization, therefore nutrition provided from the student's environment is key. "Environmental impact is thought to be one of the primary mechanisms of brain plasticity, allowing the brain to organize itself to adapt to the environment and reorganize itself to recover from injury during development" (Prado & Dewey, 2014, p. 268). The nutritionally healthy child is better able to interrelate with his or her family and environment which provides the experiences necessary for optimum brain development. Malnutrition reduces motivation, curiosity, and exploratory activities, this in turn weakens the mental and cognitive development (Garkal & Shete, 2015).

Nutrient levels in food have been found to affect student achievement; iron levels in particular have been found to be important to cognitive development. In a study to address fast food intake and academic achievement, adolescents who reported daily fast food consumption experienced low growth in academic achievement in reading and math. The information points to the importance of grades 5th through 8th as a time of great changes associated with academic achievement predictors of future academic failure and dropout. It is also during adolescent years when obesity rates increase, and children begin to acquire independent dietary and exercise habits (Purtell & Gershoff, 2015). Therefore, cohesive strategies addressing the many risk factors, particularly nutrition, are needed to help to reduce inequality and promote cognitive, motor, and socioemotional development in underprivileged children, affirming that all children have the opportunity to achieve their developmental potential (Prado & Dewey, 2014). Therefore, the relationship between nutrition and the brain should translate to school nutrition programs in the United States.

Children are at school for almost half of their waking hours and most eat two meals a day in the school setting. For this reason, school is a valuable place to introduce nutritional behavior changes. A school program that addresses dietary requirements and healthy life style education shows the most promise as a sustainable intervention. A program based on the foundation that a positive change in the schools approach to student health will come from providing children accurate information, and an environment that provides healthier food choices can succeed. In order to create this type of program, schools should develop short and long term goals to address health, safety and achievement needs of children (Oser, et al., 2014). Children need to be educated on what healthy choice are, and an improved health-focused setting makes those choices easier (Ball, Kavarik, & Leidy, 2015).

The mean reading score of a student can be predicted by the collected rates of childhood poverty. Proficiency on reading scores for the five major ethnic groups in the United States indicate that adequate progress is not being met over time for those ethnic groups with the highest percentage of children in poverty. As the diversity of students in American schools has increased over the past 50 years, the texts used for beginning reading instruction has become increasingly more complex, and the students are expected to read these texts at an even earlier age. Unfortunately, students of poverty have very limited experiences with books and struggle to connect to the topics. Compound low exposure to literacy and an unhealthy diet, and students of poverty have huge barriers to overcome when it comes to reading.

One obstacle for improving nutrition in middle schools includes budgetary restraints which as that led to a low priority for health initiatives. Unhealthy outside influences, unhealthy competitive foods at school, and views that students would not eat healthy foods has also been a barrier for change. "The limited research on administrative support has shown that administrative attitude, motivations, and support are important determinants of school nutrition practices" (Lucarelli, et al., 2014, p. 138). Therefore, school leadership can be a strategy for recognizing and supporting the need to address student nutritional health.

Statement of the Problem

Much of the recent research to address childhood nutritional needs and school nutrition programs has focused on reducing obesity and body mass index. These studies addressed the school lunch offerings compared to stringent nutritional criteria of portion size and calorie intake. Other research uncovered the impact of poor nutrition and student health on school attendance and grade retention in foreign countries but did not address cognitive function. Few recent studies were uncovered to address increasing the iron provided to students during the school day and achievement in schools in the United States. Research in the United States did support the Michelle Obama Healthy–Hunger Free Kids Act methods for providing students with more fruits and vegetable choices at school and implementation methods. However, fruits and vegetables do not provide additional iron supplementation; rather, they provide a limited amount of vitamin A and C and not the recommended daily intake. Initiatives to make schools healthier include strategies for educating students about nutrition and physical fitness, but do not change the macronutrient allowance provided at school. Nutritional implementations often do not include educating the students on why these changes may help their cognitive development. Unfortunately, the low socioeconomic sub groups in many schools are failing to meet achievement expectations. The failing schools in Georgia are primarily high free and reduced lunch populations. The researcher has determined the need for further research in the area of iron and cognitive function in schools. Therefore, the purpose of this quantitative study was to determine the impact of iron levels in a school nutrition program and the reading performance of middle school students.

Research Questions

The purpose of this study was to determine if there is a correlation between a middle school nutrition program and student Reading performance. Therefore, the overarching research question that guided this study was to ask: What is the relationship between student achievement growth as measured by Lexile score in Reading and a school nutrition program? The research study also addressed social economic status and gender in relationship to student achievement with the following research questions:

1. What is the effect of school participation in an iron-rich school nutrition program on reading achievement as measured by Lexile scores before and after implementation while controlling for middle school students' socioeconomic status?
2. What is the effect of school participation in an iron-rich school nutrition program on middle school female students' reading achievement as measured by Lexile scores before and after implementation while controlling for their socioeconomic status?
3. Is there a meaningfully significant difference in Lexile scores between male and female middle school students who participate in an iron-rich school nutrition program before and after implementation while controlling for their socioeconomic status?

Significance of the Study

A majority of the children who live in poverty suffer from malnutrition and approximately half of these children suffer from iron deficiency. Iron deficiency has been linked to impaired immune systems, changes in metabolism, and decreased cognitive function. A targeted population of infants, children, and menstruating females are at the highest risk for iron deficiency anemia. The United States and World Health Organizations have had success with interventions to address malnutrition that include: salt iodization, iron fortification, and educational interventions to address food sources.

Proper nutrition is important to brain health. The brain of a teenager continues to grow and develop during adolescence. Cognitive pathways are reorganized and strengthened during middle and high school. School food and beverages make up 35% to 51% of total dietary intake of children; these percentages are even higher for children of poverty. However, school food programs do not regulate micro or macronutrients such as iron; rather, schools are required to regulate calories, saturated fat, and salt. According to the Guidelines of Adolescent Nutrition Services, teens need up to 11 milligrams a day of iron and 15 milligrams a day for menstruating females. Unfortunately, school nutrition programs offer less than half of the daily requirement of iron. Therefore, schools may not be providing the proper nutrients required for brain health.

This research was important because schools purchase and implement several programs to address low achievement but are not addressing the brain health and cognitive function of its students. The researcher was also able to determine if improved achievement performance of the low socioeconomic population at MMS had a relationship to increasing the amount of iron provided to all students during breakfast and lunch. The impact on the cognitive function of the students informed efforts to reduce inequalities in both academic achievement and student health. The research also benefits schools across the district in order to better inform school and district leaders how to best meet the needs of high-risk low socioeconomic population.

Procedures

The purpose of this study was to determine if there is a relationship between academic achievement in reading and a school nutrition program. The researcher designed, implemented, and promoted an iron-rich school menu at one middle school. Pre and posttest intervention data was collected to determine if a correlation exists between school nutrition and Lexile growth. Lexile scores were provided from an annual state assessment given to all students in the spring. The Lexile scores were compared from archived data of the same students, before implementation, to determine growth.

This study was a correlational research design to collect and organize data on the Lexile growth of Melton Middle School (a pseudonym) students. This design was used to describe relationships between independent and dependent variables. Lexile measures were collected from the Georgia Milestone End of Grade Assessment for English language arts grade eight after the introduction of an iron rich school menu. Archival data representing Lexile scores for the same group of students for grades six and seven served as pre-intervention data sets.

Limitations, Delimitations, and Assumptions

As with all studies, there was limitations to this study that may affect the generalizability of findings. There were limitations to the validity of this design based on the reliability of the student's school nutrition choices and the consumption of those choices. A small number of students in the non-randomized sample often brought their lunch to school and all of these students fell in the *not identified low socioeconomic subset*. The nutrition value of their lunch was not within the control of the study. Also, students who received school breakfast and lunch may not have selected the most iron rich choices and may not have eaten all of the serving on a given day; oftentimes, low socioeconomic students tend to select the most filling items and consume a great portion, if not all, of that offering.

Delimitations are often identified as choices the researcher had made, and this study is no exception. The study included a maximum of 200 MMS students, which limits generalizability. Also, the assessment used to obtain Lexile scores was administered by the Georgia Department of Education to all public middle school students in Georgia; it was assumed to be a valid and reliable instrument; however, no psychometrics are made available to school administrators. In addition, the study only included those students who attended Melton Middle School for the two years prior to the intervention, and the year of intervention. The data retrieved was provided to the researcher through the Georgia Department of Education administrative portal. The researcher only had access to MMS End of Grade Assessment data, therefore the findings represented one schools results.

Definition of Terms

Georgia Milestone End of Grade Assessment (EOG) – the EOG is a comprehensive summative examination spanning grades through high school and is given in the spring of each school year. For the purpose of this study, the EOG English language arts section will provide a Lexile score (Timberlake, 2016).

Healthy Hungry-Free Kids Act 2010 – the Healthy Hungry Free Act was initiated by First Lady Michele Obama to address nutrition standards for all school nutrition programs and provided 4.5 billion in funding over the ten years (DiSena, 2015). The act was reauthorized 2013.

Lexile Framework – the Lexile Framework is a quantitative score that links text complexity and student's reading ability (Timberlake, 2016). The Lexile score provided by the EOG will be the dependent variable for the purpose of this study.

United States Department of Agriculture (USDA) – the USDA is responsible for developing and executing federal laws related to farming, agriculture, forestry, and food (DiSena, 2015).

World Health Organization – the World Health Organization is a specialized agency of the United Nations that is concerned with international public health (Murray-Kolb & Beard, 2007).

Chapter Summary

The purpose of this study was to determine if there is a relationship between middle school student academic growth as measured by Lexile score in Reading and a school nutrition program. Research has shown that children consume approximately half of their dietary intake of nutrition from school nutrition programs. Children in poverty tend to have malnutrition and iron deficiency, and often receive their only meals for the day from a school nutrition program. Students of poverty are underperforming their academic peers. The average reading score of a student can be predicted by the accumulated levels of childhood poverty. Research has found that iron can have a positive impact on brain health. Even the adolescent brain is undergoing major reorganizational changes as it prepares children for puberty. Nutrition deficiencies during the adolescent years may increase the risk of decreased cognitive function. School breakfast and lunch programs follow USDA guideline that limit portions, fats, salts, and sugars, but do not fortify vitamin and minerals necessary to impact brain health. This correlational research design determined the effect of an iron rich school nutrition program on reading achievement as measured by Lexile scores in one middle school.

CHAPTER 2
REVIEW OF LITERATURE

Introduction

Historically, students of poverty perform poorly on the state and national tests in all content areas. Nevertheless, economically disadvantaged students are expected to perform at the same levels as other subgroups. While there may be many reasons for this, iron deficiency, prominent in low socioeconomic groups, has been shown to impair cognitive abilities even in the absence of overt anemia in adolescents. Iron supplements provided to anemic schoolchildren has resulted in improved cognitive performance and intelligence scores (Murray-Kolb & Beard, 2007). In order to address student health and achievement further research is needed to be provided to address the gap in achievement between students in the lower income quartile and their academic peers. The rationales for increasing iron offerings in a middle school nutrition program will be discussed through research addressing poverty, reading, brain development and school nutrition. Kotter's 8 Stage Process will be discussed as the theoretical framework for changing one schools nutrition program.

Research conducted through the Georgia Library Learning Online (GALILEO) initiative provided by the Board of Regents of the University System of Georgia. GALILEO connects databases of periodicals and scholarly journals. Keywords included in the search for current peer reviewed scholarly articles are: achievement, adolescence, child nutrition, intellectual performance, iron deficiency, poverty, school nutrition programs, text complexity, USDA, wellness policy's, and women's health. Books on poverty reviewed included works from Eric Jenson, John Kotter, Regenia Rawlinson, and Donna Tileston and Sandra Darling.

Poverty's Impact on Student Health and Academic Performance

The Great Depression led to expansive declines in wealth, but those at the top experienced smaller declines compared with those at the bottom. As result, the level of wealth disparity in the United States increased after of the recession. According to Gini Index, which measures inequality across households, 1993 was identified as the first significant year-to-year increase in poverty since 1967. Household income inequality has increased by 20% between 1967 and 1993 (Mather & Jarosz, 2014). The tipping point for inequality is that it limits mobility, consumer spending, educational attainment, and the ability of the United States to compete in the global economy. Rising poverty levels have decreased opportunities for millions of children compared with previous generations. Children born to families in the bottom fifth of the income distribution have a 36% chance of remaining in the same income quartile when they reach adulthood (Mather & Jarosz, 2014). The impact continues today; between 2007 and 2013, average wealth among the top 5% of households fell by 16% compared to 43% decline among the middle class. "By 2013 the top 5% of households had an average net worth 24 times that of households at the 50th percentile" (Mather & Jarosz, 2014, p. 3). Contrary to some beliefs, White children represent the largest number of children of poverty in the United States. However, children from other racial groups represent the largest percentage of children living in poverty. Social labeling often projects poverty in terms of African American, Hispanics, and Native Americans. From a collective perspective, there are more Whites below the poverty line than African Americans, 20 million to 9 million. "From a percentage perspective, 25% of African Americans live below the poverty line and only 10% of Whites live below the poverty line" (Tileston & Darling, 2008, p. 13). African American populations who live in poverty are located in densely populated urban areas, while poor whites tend to be more scattered in rural areas, mountain regions, trailer homes, and other types of housing.

Socioeconomic status and student achievement has been studied throughout the world. The United States No Child Left Behind Act (2002) specifically addressed closing the achievement gap between economically disadvantaged children and their more economically advantaged peers as one of the goals of the act. As the government reauthorizes its educational act, most recently Every Student Succeeds Act (2015), the economically disadvantaged students continue to be a prioritized subgroup. Nevertheless, the achievement gap between students from low- and high- income families continues to increase. "As income inequality continues to grow in the United States, the achievement gap becomes an even more critical issue than it was in the past" (Huang, 2015, p. 5). Students who suffer from lower socioeconomic living conditions are less likely to succeed in elementary and secondary schools and to attend a higher education institution. "A 2006 Program for International Student Achievement outlines that the United States has the largest existing achievement gap among students with differing socioeconomic status, when compared to other developed countries" (Bellibas, 2016, p. 693). As states address this issue some strategies have shown to help lessen the gap. High expectations, strong school leadership, great teachers, and parent and community involvement have been identified to impact achievement for students of poverty. In addition to assigning high quality teachers to low socioeconomic environments, Bellibas highlighted the importance of "basic life needs" (p. 693) for students of poverty.

In a 2000-2013 review of literature by Halim, Spielman, and Larson (2015) the researchers examined economic consequences of nutrition interventions for low and middle income countries. Their research recovered that 90% of the women and children in low-income countries suffer from malnutrition (Halim, Spielman, & Larson, 2015). The researchers detailed that nutrition interventions in these countries not only showed health improvement, but also showed an "increase of school enrollment, cognition, labor capacity, productivity, and earnings in adults" (Halim, Spielman, & Larson, 2015, p. 13). The study concluded that health interventions are economically beneficial for deceasing poverty, especially in low-income countries.

The United States created the Women, Infant and Children Food and Nutrition Service (WIC) in 1972. WIC provides federal grants to states for supplemental foods, health care referrals, and nutrition education for low-income pregnant, breastfeeding, and non-breastfeeding postpartum women, and to infants and children up to age five who are found to be at nutritional risk (Halim, Spielman, & Larson, 2015). Interventions such as food aid and iron supplements have shown to increase birth weight and reduce premature births. When children are a healthy height and weight for their age they may start school on time, progress through school on schedule, have improved cognition skills, and have higher school achievement. Nutrition interventions are recognized as an investment in the potential for economic productivity.

The demand for higher skilled and higher educated workers in the United States will only continue to grow. More and more, proper nutrition separates those at the top from those at the bottom. According to the World Health Organization; investments in nutritional interventions are key to reducing disparities between population groups

(2014). From preschool through college, education provides the skills necessary for success later in life. If current levels of inequality persist, younger workers and their families will struggle to earn the middle class wage needed to replace older generation in the workforce, or seek higher paying jobs to stop the cycle of poverty in their family. Reducing disparities, especially by reducing gaps in nutrition, will not only improve conditions for lower income parents and their children, but will also support educational attainment by creating a well-qualified workforce (Nurse, Dorey, Yoa, Sigfrid, & Yfantopolous, 2014).

Poverty and its related risk factors are damaging on the physical, social emotional, and cognitive well-being of children and their families. Data from the Infant Health and Development Program showed that 40% of children living in chronic poverty had deficiencies in at least two areas of function, language and emotional responsiveness (Jenson, 2009). Socioeconomic status is strongly associated with a number of indicators of a child's cognitive ability, including achievement tests, grade retention, and literacy skills. There is a gap between poor and affluent children's performance on just about every measure of cognitive achievement. "The correlations between socioeconomic status and cognitive ability and performance are typically quite significant and persist throughout the stages of development, from infancy through adolescence into adulthood" (Jenson, 2009, p. 31). Low socioeconomic children are often more likely to have health and safety issues such as malnutrition, exposure to environmental hazards, and insufficient health care.

Schools often try to make kids "smarter" by simply trying to deposit more curriculum into their brains. This strategy is not supported by science and typically fails by making students feel frustrated and agitated. "Students with a poverty mind-set often feel powerless and think they have no control over what happens in their lives" (Rawlinson, 2011, p. 24). These students may blame their circumstances and other people. Students from low socioeconomic homes look to others to work things out for them; they attach failure to their circumstances rather than their deficiencies. Children of poverty enter school with a "not enough" mindset (Rawlinson, 2011). Students equate scarcity in their lives, such as food, heat or clothing, to results in school. They may think that only a few students will receive A's or only one project will be selected as the best. Therefore, they may choose to not put in as much effort for what they believe may be of limited supply.

The January 2014 reading report from the Annie E. Casey Foundation stated that children who read proficiently by the end of third grade are more likely to graduate from high school and become economically successful in adulthood. The mean reading score of a student can be predicted by the collected rates of childhood poverty. The National Assessment of Educational Progress (NAEP) reports that 80% of low-income fourth graders are not proficient in reading. Proficiency on reading scores for the five major ethnic groups in the United States indicate that adequate progress is not being met over time for those ethnic groups with the highest percentage of children in poverty, some have lost ground since 1992 (Tileston & Darling, 2008). Research has shown that as early as eighteen months of age low-socioeconomic children begin to fall behind in literacy skill development. "These children are less likely to be read to or to be spoken to regularly or to have access to books, literacy-rich environments, high quality early care, and pre-k programs" (Corvington, 2016, p. 20). Even with exposure to quality care, many children may still not be healthy and developmentally ready to learn. "Kids raised in poverty need more than just content, they need capacity" (Jenson, 2009, p. 54). Schools and communities must become the advocates to make sure students are healthy and developing properly.

Reading Readiness and Lexile Growth

Even before the reauthorization of No Child Left Behind to become the Every Student Succeeds Act (ESSA), there have been requirements for educational measurement and accountability. The focus on achievement progress requires schools to set goals for student performance. The federal government allows states the flexibility to propose growth models to address the ESSA requirements. Georgia has identified reading and Lexile growth as an achievement criteria for each individual school and school system. The state has also set progressively increasing performance targets for all students, regardless of the changing demographics of the state or community.

Over the past fifty years the national demographics have changed as immigrations policies have evolved. In 1960, 86% of the first grade population was White; in 2006 that number had declined to 56.5% (Hiebert, 2015). The largest change in demographics has been in the increase of students who are Hispanic. These differences in ethnicity relate to diversity in children's native languages, poverty levels, and literacy patterns in homes and communities.

Not only has the population's demographics changed but so have children's experiences, which has an effect on literacy. Cultural differences impact children's understandings of holidays, the community, and family dynamics. The increased exposure to literacy-related media, such as television and movies, has changed how children see story telling and the world around them. Educational programing on television and the boom of technology, such as iPads with educational applications, has provided more information to some even before entering school. More homes, libraries, and community organizations provide books and reading programs than in the past. Many households require parents to work outside the home increasing the time children are in non-parental care. Sometimes by a grandparent, sibling, or daycare setting takes on the primary day to day childcare.

Prior to the 1930's, early childhood reading books consisted of high frequency words and phonetic rhyming sounds. In the 1960's entry level texts for first grade contained less than twenty words with frequent repetition and phonetic regularity. In the 1990's, entry text had 79 words, less phonetic regularity, and more single use words. By 2008, the entry-level text was introduced in kindergarten with an average of 33 words with similar phonetic make up. The 2008 text taught in first grade averages 131 words and 71% phonetic regularity. Just 5 years later, in 2013 the entry kindergarten text averages 35 words and 43% phonetic regularity, and the entry first grade text averages 129 words (Hiebert, 2015). The use of single appearing words increasing, while phonetic words were decreasing. In brief, as the diversity of students in American schools has increased over the past 50 years, the texts used for beginning reading instruction has become increasingly more complex, and the students are expected to read these texts at an even earlier age. Therefore, students of poverty are entering school unprepared for the increased rigor imposed in reading, and may also not be healthy enough to begin to rise to the challenges.

In a study designed to improve comprehension for middle school students, Ramsey and Sperling identified the three main variables that impact reading as reading ability, interest in the topic, and beliefs in the content specific ideas and concepts. In the study, 229 fifth, sixth, and eighth grade students participated in a comprehension pretest and posttest design. Subjects were provided perspective about the reading task prior to reading informational text. The researchers' background research stated students in fourth grade and beyond should have adept reading skills in order to move on to informational texts. Unfortunately, the research on adolescent literacy states that many middle school students do not have the skills to move on to more text complexity. The results of the study showed an increase in comprehension on post test results when perspective was presented prior to reading the passage. However, the results also showed that reading lengthy text posed a significant challenge to readers in terms of comprehension (Ramsay & Sperling, 2015). Eighth grade students in the study had the longest passages and difficulty with comprehension. Therefore, prior knowledge, or lack of, impacts comprehension. Students of poverty have limited experiences when it comes to reading informational text. Longer passages are even more difficult to comprehend possibly because of cognitive ability and loss of interest in the topic.

Unlike measuring growth in terms of height or weight, there was no universal measurement for reading achievement. Each reading test had its own proprietary metric. Near the end of the twentieth century MetaMetrics Inc. developed a common metric for reading called the Lexile Framework for Reading (Williamson, 2006). Measuring reading ability is determined by a student's response to comprehension and vocabulary questions on progressively more complex text passages. Williamson (2006) explained that to measure growth there must be constancy or invariance in the construct over time. It is important to measure the same thing, in each assessment setting to measure growth. MetaMetrics uses panel norms, assessing the same individuals on multiple occasions. They also use cross-sectional norms for comparison with in grade levels. Expected Lexile growth from seventh to eighth grade is 64 Lexile points (Williamson, 2006), however an individual student's starting Lexile affects their individual growth. According to Williamson's white paper on expected growth, average Lexile growth gradually reduces as the grade level increases. More complex texts in higher grades may result in lower growth averages.

Text complexity continues to become challenging in higher grades. The push may be coming from the United States Department of Education expectations for achievement levels through assessment. Some national benchmarks expect an annual growth of 163 Lexile levels in elementary school and an annual growth of 53 Lexile levels in secondary grades (Allington, McCuiston, & Billen, 2015). "Text complexity was originally measured by oral reading accuracy and comprehension, simply how accurately a student read a text" (Allington, McCuiston, & Billen, 2015, p. 492). A number of scholars have debated the accuracy of silent reading comprehension compared to oral reading comprehension. However, the original reading criteria has sustained and is accepted as the procedure for determining the difficulty or complexity of a text used for reading instruction and assessment.

Teachers, schools, and educational systems are attempting to address the gap between what students need to be able to do by increasing the complexity of the texts students read. Educators are also increasing the rigor associated with what students are to be able to do with the text. "Specifying the kind of knowledge skills, reading, and reasoning strategies that students need to demonstrate competent critical literacy reasoning and interpretations with complex texts" (Lee & Goldman, 2015, p. 214). Text complexity can also be evaluated by the number of words per sentence or passage and concreteness of the vocabulary. Concreteness can be explained by the straight forward, concrete definition of words and subjects. There are important differences between what a 7th grader versus a 12th grader is likely to understand, as well as what a student from one culture to another may accept as normal or strange.

In a study designed to improve reading outcomes for students with disabilities researchers used informational texts in social studies. The study took place in seven middle schools in the Southeast and Southwest United States. Traditionally students with disabilities receive accommodations for reading, particularly for informational text. Over 6 to 10 weeks of instruction teachers focused on comprehension, vocabulary, knowledge acquisition, and assessment checks. The results showed an increase in posttest scores; however, intense special education services continued to be required to address the text complexity of the social studies informational text (Swanson, Wanzek, Vaughn, Roberts, & Fall, 2015). The study used traditional reading methods but did not address the gaps of prior knowledge to support the learning. Socioeconomic data was not provided, therefore the impact of poverty on the outcomes cannot be determined.

Nonfiction informational text does not follow the conventions of fiction that students are familiar from movies and television. The brain's active processing capacity is limited, so unless some prior knowledge is established in long-term memory, attempting to make connections actually slows down the cognition process. "Knowing things helps you think and read successfully" (Lemov, 2017, p. 10). Some readers are trying to connect the dots. One of the beliefs in U.S. education is that the methods for teaching formal reading also applies to reading nonfiction, and that these skills apply to the ability to read anything. Understanding an informational text may not be because of inferencing skills, but rather the result of prior knowledge. Unfortunately, students of poverty have very limited experiences and cannot connect to what they are reading. It might be better to build students' background knowledge rather than inferences, character motivation, and summarizing.

Brain Development and Brain Health

Sufficient nutrition is necessary for average brain health. Nutrition is especially important for children during early growth and development, which are critical times for building the basis for cognitive, motor, and socioemotional skills throughout childhood and adulthood. Therefore, nutritional weaknesses during the mother's pregnancy and infancy affect cognition, behavior, and productivity throughout school years and adulthood. "Approximately 22 days after conception, the neural plate begins to fold inward, forming the neural tube, which eventually become the spinal cord. Adequate nutrition is necessary from the beginning, with formation of the neural plate and neural tube" (Prado & Dewey, 2014, p. 268). After the neurons are created, they grow axons and dendrites. This process begins during gestation and continues throughout the early years of development. Groups of neurons continue to develop pathways, which are developed and refined throughout childhood and adolescence. As a child approaches adolescence, the prefrontal cortex continues to mature, with a significant spurt of growth just before puberty. Once the child reaches adolescence, scientist have determined that teens undergo another burst of "synapses pruning," as important connections are strengthened as unnecessary ones are discarded (Sukel & Reed, 2015, p. 13).

Some maturing of neural pathways depends on input from the child's environment. Adequate nutrition is an aspect of the environment and important to normal brain development. Poor nutrition is more likely to harm brain development if the deficiency occurs during a time period when neural development is high (Prado & Dewey, 2014). The adolescent brain is undergoing an important developmental reorganization, therefore nutrition provided from the student's environment is key. "Environmental impact is thought to be one of the primary mechanisms of brain plasticity, allowing the brain to organize itself to adapt to the environment and reorganize itself to recover from injury during development" (Prado & Dewey, 2014, p. 268). The nutritionally healthy child is better able to interrelate with his or her family and environment which provides the experiences necessary for optimum brain development. Malnutrition reduces motivation, curiosity, and exploratory activities; this in turn weakens the mental and cognitive development (Garkal & Shete, 2015). Healthy nutrition provided throughout development is imperative.

In a large meta-study on intelligence, leading scientists described IQ as malleable. Unfortunately, children who are not well nourished are at risk for weakness in their ability to form cognitive, motor, and socioemotional skills. Healthy cognitive, motor, and socioeconomic abilities are strongly linked to academic achievement and economic productivity. Therefore, cohesive strategies addressing the many risk factors, particularly nutrition, are needed to help to reduce inequality and promote cognitive, motor, and socioemotional development in underprivileged children, affirming that all children have the opportunity to achieve their developmental potential (Prado & Dewey, 2014). Therefore, the relationship between nutrition and the brain should translate to school nutrition programs in the United States.

In a 2015 nutrition study conducted by Garkal and Shete, a correlation between impaired cognitive function and malnutrition was found in primary school children in India. In this quantitative study, 200 school children ages five to nine years old were selected. The researchers obtained parent permission, socioeconomic status, and information on the student's dietary habits. Nutritional grades were assigned according to classifications from the Indian Academy of Pediatrics (Garkal & Shete, 2015). An IQ score was measured by Kamat's psychological test designed for the student's chronological age (Garkal & Shete, 2015). If the student answers all questions correctly, additional questions for a higher age were asked until the student fails to answer correctly. Scores were then grouped in three categories: superior, average, and below average IQ. The results showed a progressive reduction in IQ development as the degree of malnutrition advanced. The study concluded that nutritional and socioeconomic status significantly affect the development of IQ in school children (Garkal & Shete, 2015). Therefore, the results of the study also indicated that malnourishment was associated to low socio economic status, which influenced IQ development.

In a 2007 nutrition study conducted by Murray-Kolb and Beard, a relationship was found between iron status and cognitive abilities in young women. In a quantitative study, 113 women ages 18-35 participated in a double-blinded placebo-controlled intervention study (Murray-Kolb & Beard, 2007). Pennsylvania State University conducted its search criteria by taking blood samples from female volunteers to measure iron levels. The women were stratified into three iron status groups: sufficient, iron deficient, and iron deficient anemia. Participants completed a baseline cognitive test of the computerized Cognitive Abilities Test (CogAT). The subjects were randomly assigned a slow release iron supplement or placebo. After 16 weeks of treatment, the women were reassessed on the CogAT. The study showed that iron deficient subjects had poor performance on cognitive tasks and the time to process the information required was higher than iron sufficient subjects. After treatment with an iron supplement CogAt score increased and the time to complete the test decreased. Therefore, the study concluded that "Iron status is a significant factor in cognitive performance in women of reproductive age" (Murray-Kolb & Beard, 2007, p. 786). Therefore, female nutrition and brain health is an important area to explore.

Research gathered from the Sekhar 2016 study on anemia and women stated that adolescent women with iron deficiency anemia might experience negative cognitive function, decreased audiovisual reaction time, and decreased physical performance. Symptoms increase rapidly with iron supplements. The study used data from the National Health and Nutrition Examination Survey results from mobile examination centers. Lab data were collected from women 12-49 years of age, medical, and reproductive history. Social and behavior determinants were used to identify risk factors. Adolescent woman differ in many ways from older women in terms of risk of anemia. Adolescents require different nutritional requirements, experience varied menses duration, and are less likely to use contraceptives (Sekhar, Murray-Kolb, Kunselman, Weisman, & Paul, 2016) The study concluded that more research is need to better identify anemia risk factors specific for adolescents. Therefore, a closer look at school nutrition programs may reveal information regarding health and nutrition factors for adolescents.

School Lunch Policies and Limitations

Prior to the 1940's, school lunch programs first sought to curb childhood hunger mainly through local efforts supported by charities. Through contact with children on a regular basis, schools became aware of how many children from impoverished families were not receiving proper nutrition. In an effort to address malnutrition, individuals took action and sparked the creation of lunch programs in many of the country's largest cities. Interestingly, the federal government did not show interest in this effort until the Great Depression. One motivation of the creation of a federal school lunch programs was to prevent children from being hungry. The other incentive was financial, as the federal government was also attempting to recycle agricultural surplus that affecting food prices after the Great Depression (DiSena, 2015).

On June 4, 1946, President Harry Truman signed the National School Lunch Act giving the United States its first permanent school lunch program. "The National School Lunch Program allowed the federal government to dispense aid to states to assist school districts with food and equipment used to help serve free and reduced lunches to underprivileged children" (DiSena, 2015, p. 173). In 1966, President Lyndon B. Johnson signed the Child Nutrition Act of 1966 in conjunction with the War on Poverty. The Act established a federally assisted School Breakfast Program and Special Milk Program. In 1970, the National School Lunch Act was later reformed through Public Law 91-248, which tried to amend the goal of school lunch to one that addressed child nutrition.

According to the National School Lunch Program 2016-2017 data, the nation's schools served 17 million breakfasts and 5 billion lunches (2017). The cost of producing a school meal differs from one state and school system to the next due to regional variations in food, labor, fuel costs, school equipment, and infrastructure. In April 2008, USDA released its *School Lunch and Breakfast Cost Study-II*, which examined the cost of producing a school meal during school year 2005-06. The study found that, on average, the full cost to produce a school lunch was $2.91, exceeding the free lunch subsidy, then $2.495. Forty-eight percent of the cost to produce school nutrition programs is for labor and benefits. Thirty-seven percent of the cost goes to food, and the remaining fifteen percent is for supplies (School Nutrition Association, 2017). Lunch at MMS costs $1.50, well below the national average.

During the 1980s, parent and child advocacy groups increased awareness of the inconsistency between the USDA's dietary advice and their own food assisted programs. In 1994, the Healthy Meals for Healthy Children Act was passed to address discrepancy concerns. The Healthy Meals for Healthy Children Act required participating schools to serve meals in compliance with the Dietary Guidelines for Americans (DiSena, 2015).

The Healthy Hunger-Free Kids Act (HHFKA) of 2010 was an element of former First Lady Michelle Obama's "Let's Move" campaign, which encouraged the USDA to strengthen the federal nutritional standards for school meals. The law reauthorized funding for federal school meal and child nutrition programs, providing $4.5 billion in new funding over ten years. "Most schools are required to increase the availability of fruits, vegetables, whole grains and fat-free and low-fat fluid milk in school menus; reduce the levels of sodium, saturated fat and trans fat in meals; and meet the nutritional needs of school children within their calorie requirements" (DiSena, 2015, p. 178). Under this Act, the USDA was also allowed to set standards for nutrition education, physical activity, and wellness policies, and to establish links between schools and local farmers to make sure that local produce is used in the school setting. The HHFKA extended the nutritional standards in the school setting by applying USDA's regulations to all food offered within or outside of the school meals program, including a la carte, vending machines, and other foods sold in school settings (DiSena, 2015). HHFKA has been criticized, for expecting healthier meals that cost more, but are less appetizing to students, and for providing smaller portions that are not enough for some students due to the calorie restrictions imposed by the new standards (Greece, Kratze, DeJong, Cozier, & Quatromoni, 2015).

School children do not consume the international recommendation of eating at least 400g of fruit and vegetables (FV) daily. Research on adolescents has shown that they consume inadequate amounts of vitamins and minerals, stressing low consumption of vitamin A and E, iron, and calcium (Oser, Beck, Alvarado, & Pang, 2014). The study stressed the deficiency was more pronounced in females than males. The same research suggested that milk is the primary component of school lunch responsible for participants consuming protein, vitamin A, and calcium (Oser, et al., 2014). In assessing school breakfast, vitamin C was the only nutrient consistently consumed by participants. Therefore, participation in the school nutrition program could be an important element in providing nutrition to children at school as well as nutritional quality. Educating students about the benefit of school nutrition programs could promote participation.

A 1984 program impact study by Hanes, Vermeersch, and Gale sighted research that supported the consumption nutrient rich school food offerings, which established the importance of school nutrition programs. The Health and Nutrition Examination Survey and the Nationwide Food Consumption Survey have shown that large portions of school-aged children in the United States do not consume the recommended daily amounts of some nutrients, especially iron, magnesium, vitamin B, vitamin A, and calcium. The study interviewed 5,212 children grades third though twelfth. Students shared what they ate within a twenty-four hour period. The study did find that school lunch participants did receive more protein, vitamin A, calcium, phosphorus, and riboflavin than school lunch nonparticipants. Vitamin C was the only nutrient school breakfast participants received more of than school breakfast nonparticipants. The results were attributed to the amount of food consumed, milk and juice offerings. The question of quantity versus quality is particularly important because school nutrition programs are more efficient if participants have diets that contain more nutrients than diets of nonparticipants. The study concluded that school lunch programs contribute to maintaining and improving the health of the nation's children (Hanes, Vermeersch, & Gale, 1984). Therefore, school nutrition programs are an established program that can be tailored to provide more healthy options to impact cognitive function.

The National School Lunch Program has provided more than 224 billion lunches to school children since its inception in 1946. A nutrition program operates as a federally assisted meal program that offers reduced cost or free lunches to students. The USDA manages the National School Lunch Program at the federal level. State agencies then operate the program in agreement with the terms of the state's contract with the USDA

(DiSena, 2015). A school breakfast program is a federally supported meal program operating in public and nonprofit private schools and residential child care establishments. It began as a pilot project in 1966, and was made permanent in 1975. The School Breakfast Program is administered at the federal level by the Food and Nutrition Services; at the state level, the program is usually controlled by State education agencies that operate the program through arrangements with local school food directors.

Restaurants and grocery stores are beginning to change and address the changing culture on what and how people eat. A 2016 School Nutrition magazine addressed plant protein options for students. Casselbury (2016) confirmed that protein is a building block of life. "Protein plays a role in all bodily functions" (p. 67). In the background the author addressed the lack of protein in school lunches. The requirements, per the Dietary Reference Intake, indicate that children are in need of .95 grams of protein per pound of weight as opposed to .36 grams of protein per pound for adults (Casselbury, 2016). Therefore, a student who weighs one hundred pounds should be consuming 95 grams of protein a day or 3.35 ounces. Casselbury discussed that different foods contain different amounts of protein, but as a rule, the National School Lunch Program requires two ounces be served to grades nine through twelve and one ounce to younger students (Casselbury, 2016). Schools Lunch Programs may rely on students receiving protein at other times of the day, but for many students of poverty, they are not.

In a 2015 study conducted by Doung, Mora-Plazas, Marin, and Valimor, an associated risk was identified for grade repetition and absenteeism for children with iron and vitamin B-12 deficiencies. In this quantitative study 3,156 children ages five to twelve years old from public schools in Bogota, Columbia, provided blood samples at the beginning of the school year. Absenteeism and grade retention information was provided by the Secretary of Education to confirm school year outcomes. Laboratory methods provided micronutrient levels in the student's blood samples. The results reported that students with deficient biomarkers such as B-12 and iron had twice the absenteeism rate then their healthier peers (Douong, Mora-Plazas, Marin, & Villamor, 2015). Students deficient in B-12 and iron also reported three times higher risk of grade repetition. Therefore, the study concluded that iron and B-12 deficiency are associated with poor attendance and grade repetition primary school children in Bogota, Columbia.

In another study conducted in India in 2013, Priya et al. (2016) provided iron supplements to school children in ninth and tenth grade. The researchers received permission from headmasters at two government schools and selected 240 students for the study. After providing the students with the iron supplements, qualitative data were collected. The results showed that 47.2% actually took the supplement. Those not taking the supplement predominantly sited stomach upset and vomiting. Of the students who did consume the iron supplement, they reported reduced fatigue, increased appetite and improved concentration as the major benefits of the tablet (Priya, et al., 2016). The research team concluded that the benefits of the iron intervention were positive; however, careful program implementation would be needed to use an iron supplement tablet in schools. The policies and limitations imposed on school nutrition programs limit the nutritional impact cafeterias can have on their own. A school-wide approach to nutrition and academic support could support student achievement.

How Schools Can Help

Schools are a primary focus of health promotion because most children attend school and spend a significant amount of time in school, thus making schools crucial locations to reach children and their families. Students are influenced by teacher activities and school-based activities. Therefore, schools in which healthy eating and physical activity are encourages is a logical place to address nutrition. However, until July 1, 2006, schools were not required by federal regulation to address key components of a healthy lifestyle, specifically physical activity and nutrition. The Child Nutrition and WIC Reauthorization Act of 2004, which was enacted in 2006, required schools to adopt local school wellness policies. The law applies to all districts participating in federal school nutrition programs, such as breakfast and lunch (Buns & Thomas, 2015). However, the content of the school wellness policies do not require specific wording for policy goals or any references to the main goal.

In a 2014 school health study conducted by Lucarelli et al. identified key characteristics in successful schools with healthy school climates. The researchers found that on a typical school day American children consume between 35% and up to 51% of their total dietary intake from low-nutrient, carbohydrate dense food and beverages (Lucarelli, et al., 2014). The qualitative study was designed to deepen the understanding of the decision making process influencing children's eating at school. The researchers identified eight Michigan middle schools that contained 50% or greater students eligible for free or reduced lunch. They conducted interviews of administrators, school service staff, and teachers. Questions included policies, school service operations, and how schools used at the school (snacks, reward, and concessions). The transcripts were coded into four themes: challenges, economic influences, family influences, and school food. The results indicated that budget had a large impact on the prioritization of menu selections. Findings also revealed that availability of unhealthy food options and the perception that students will not chose healthy foods affected decision making at the schools (Lucarelli, et al., 2014). Overall, administrative attitude, motivation, and support are important determinants of school nutrition practices.

School-based efforts combining educational and environmental strategies have proved effective in increasing children and adolescents' iron intake. However, such interventions are difficult to implement according to the research of Jorgensen (2015). Jorgensen's work also noted conflicting results on the association between the way schools delivered dietary interventions and adolescents dietary behavior change (Jorgenson, et al., 2015). While there are a number of previous studies on the effect of curriculum health and nutrition initiatives addressing iron intake among adolescents, many do not address subgroups such as girls and children of low socioeconomic status (SES). Some studies do show that health educational strategies are not as effective among susceptible groups such as low SES and girls, whereas others suggest that subgroups with low baseline values respond better to iron interventions. It is, therefore, applicable to study the importance of health and nutrition initiatives for adolescent by subgroup (Jorgenson, et al., 2015). Endeavors to improve children's diets have focused on improving nutrition education and the nutritional value of foods offered at school through policy and environmental changes. The success of school nutrition interventions could likely be improved if there were more understanding of the decision-making processes, the physiologic needs of children, and the outside influences that affect what children eat at school.

Children are at school for almost half of their waking hours and most eat two meals a day in the school setting. For this reason, school is a valuable place to initiate nutritional behavior changes. A school program that addresses dietary requirements, healthy life style education, and parental involvement shows the most promise as a sustainable intervention. A program based on the foundation that a positive change in the schools approach to student health will come from providing children accurate information and an environment that provides healthier food choices can succeed. In order to create this type of program, schools should develop short-term and long-term goals to address health, safety, and achievement needs of children (Oser, et al., 2014). Children need to be educated on what healthy choice are, and an improved health-focused setting makes those choices easier (Ball, Kavarik, & Leidy, 2015).

A few barriers for improving nutrition in middle schools includes budgetary restraints that led to a low priority for health initiatives, unhealthy outside influences, unhealthy competitive foods at school, and views that students would not eat healthy foods. "The limited research on administrative support has shown that administrative attitude, motivations, and support are important determinants of school nutrition practices" (Lucarelli, et al., 2014, p. 138). Therefore, school leadership can be seen as another key factor in the change by recognizing and supporting the need to address student nutritional health.

Theoretical Framework and Application

The researcher chose to apply the Kotter's Eight Stage Process to Creating a Major Change (1996) to the issue of transforming the school nutrition program to serving more iron rich food offerings to students in the role of the school principal. The goal of this research is to impact school nutrition in such a way that it can expand and last for many years to come. The focus of this researcher's study is to impact student cognitive function, all eight-change strategies are being used to lead a sustainable change in one schools nutrition program. The leader will be able to translate big thoughts into concrete steps for action. One way to start a transformational program is to step back and analyze the organization through the Kotter's eight-stage process for change with school nutrition and student cognitive function in mind.

Leadership theorists often debate about leading versus managing organizations. Kotter does not separate the skills sets but defines them as complementary concepts. Kotter's 1990 work on leadership and management has defined leadership as setting directions, motivating and inspiring, whereas management is planning, organizing and problem solving (Drysdale, Gurr, & Goode, 2016). Kotter used captivating stories based on actual experiences to change how people approach leadership roles. The researcher/ principal chose Kotter's Eight Stage Process because it emphasizes the *why* and *how* elements of the change process. The steps are: establishing a sense of urgency, creating the guiding coalition, developing a vision and strategy, communicating the change vision, empowering a broad base of people to take action, generating short-term wins, consolidating gains and producing even more change, and institutionalizing new approaches in the culture. In the following, each step will be described in general terms and then applied to the principal's efforts to create a school nutritional program to provide more iron-rich food offerings in order to support student academic achievement.

Establishing a Sense of Urgency

According to Kotter (1996), it is important to reduce complacency in an organization. Kotter declared that individuals will admit there is a problem, but do not feel that it is something that they can impact, or that it is their problem to solve. Kotter addressed complacency sources in depth from management, perception, and structure. To establish urgency for the nutritional needs of the students, the principal presented the information as a crisis at the beginning of the 2015-2016 school year, year two of the study. Stakeholders included: teachers, staff, cafeteria staff, School Council, and the Parent Teacher/ Student Association (PTSA). Staff preplanning meetings with the faculty looked at research, open house parent meetings received a nutrition fact sheet, the school council discussed the topic at the first quarterly meeting, the principal explained the importance of nutrition to the students at the first assembly, and the cafeteria staff met with the principal about the nutritional requirements for adolescents. All stakeholders were informed of the recommended nutritional requirements for adolescents and what is actually being offered by the school.

Creating a Guiding Coalition

Kotter's (1996) research also addressed the role of people within the organization as they learn to solve problems and support each other through effective problem solving strategies. The principal engaged in strategies of shared decision making, provided opportunities for participation, and work towards enlisting commitment to change. The principal built a team that was able to affect change in school nutrition to include district and school cafeteria staff, teachers, students, and parents to meet and discuss school nutrition and academic achievement. It should be mentioned, that while in the process of building a coalition, the school district Food and Nutrition Manager hired a full time nutritionist in 2015 as a strategy to address the menu concerns discovered.

Developing and Communicating a Vision and Strategy

Once the principal established the need for a change through uncovering a crisis and worked to build a coalition of support, a vision and strategy for the initiative was established. Therefore, the vision for school nutrition changes is to level the playing field for student health and achievement. The principal repeated the vision often, shared it in multiple forums such as faculty, PTA, School Council, and school assemblies. Together the team built a timeline and considered the budget.

Meetings with the district and school cafeteria staff involved evaluating the nutritional value of existing school menu items, researched changing recipes to increase the iron quality, changing the overall menu to repeat iron rich items every week as opposed to every two weeks, and adding new iron rich items to the menu. The researcher involved students and teachers in the year two process by including both groups in the taste testing of new items and providing feedback of what they would like to see on the school menu in connection to the vision. The principal provided updates at faculty, School Council, and parent meetings of the menu changes and solicited feedback from students and teachers. Parents were asked to provide feedback of the process. The researcher has remained available to listen in order to better align systems to the vision.

In year three, the menus were established for the year based on planning from the Guiding Coalition. Principal communicated updates at the start of the year school meetings, and addressed the changes based on the planning to the school nutrition program. The principal made short videos to air on the school morning announcements promoting the iron-rich food choices as “smart food”. The video reminded students how nutrition affects brain health and by choosing “smart food” for breakfast and lunch will impact the cognitive function of their brain. Feedback throughout year three was be used to monitor and adjust the needs of the stakeholders to ensure quality and integrity of the initiative.

Empowering Broad-based Action

To address the barriers that may sabotage a change in school nutrition, the principal must start with the vision that was created. As Kotter (1996) so aptly stated, “Strong structural silos undermined the teams” (p. 103). In order to include the school nutrition staff as a part of the whole schools mission, it will be important to change the perception of the role of school nutrition programs to supporting the academic gains of the students. Therefore, the cafeteria manager was invited to stakeholder meetings to be informed in all aspects of the school. The principal visited the District Food and Nutrition office monthly to discuss the project and to stay informed of their related issues. Budget restrictions and mindsets about student food preferences were addressed at every strategy meeting with the stakeholders. The vison of leveling the playing field for student health and achievement remains the focus.

Generating Short-Term Wins

For the purpose of this research, the impact of increasing iron rich food choices to positively impact cognitive function will be measured by Lexile growth in reading. The school has several in-house reading tools to be used to address short-term wins. The project coalition proposed strategies for using school nutrition participation and reading for rewards. Rewards are currently awarded based on the Accelerator Reading program goals and students' progress toward the state twenty-five book requirement. Additional rewards will be given to students participating in school lunch. The cafeteria manager can purchased healthy snack items such as fruit popsicles to give to students who participate in school lunch. These items are sporadic and fruit based which will not interfere with the proposed study.

Consolidating Gains and Producing More Change

This principal encouraged the collaboration of the cafeteria staff and the instructional staff, but did not want to discourage autonomy. The team made menu decisions together but the cafeteria staff was be able to make purchasing decisions without the approval of everyone. However, the step of evaluating and creating more change may be a long process for an organization and the true results of the change effort may not be evident within the confines of this study. The researcher understands that changing the cognitive function of the brain through nutrition is not a quick process and has planned long term.

Anchoring New Approaches in the Culture

The researcher plans to increase sustainability of iron rich food offerings through educating the students, staff, and parents. If students like the food choices offered at school, they will continue to choose and purchase them. The demand for these menu items will encourage the cafeteria staff to continue serving the items. Inviting parents to have lunch with students and communicating the initiative through PTSA meetings and newsletters will also help. Educating the staff on the benefits of increased achievement through students eating healthier food choices will continue to bring the staff on board. The goal is that it will be self-sustaining because it will have a positive impact on achievement.

Chapter Summary

A majority of the children who live in poverty suffer from malnutrition and approximately half of these children suffer from iron deficiency, Iron deficiency has been linked to impaired immune systems, changes in metabolism, and decreased cognitive function. A targeted population of infants, children, and menstruating females are at the highest risk of iron deficiency anemia. The United States and the World Health Organizations have had success with interventions to address food sources. Proper nutrition is important to brain health. The brain of a teenager continues to grow and develop during adolescence. Cognitive pathways are reorganized and strengthened during middle and high school. However, school food programs do not regulate micro or macronutrients such as iron. Unfortunately, school nutrition programs offer less than half the daily requirements of iron, which indicates that schools are not providing the nutrients required for brain health.

Based on the review of literature much of the recent research to address adolescent nutritional needs and school nutrition programs has focused on reducing obesity and body mass index. These studies addressed the school lunch offerings compared to stringent nutritional criteria of portion size and calorie intake. Other research uncovered the impact of poor nutrition and student health on school attendance and grade retention in foreign countries but did not address cognitive function. Few recent studies were uncovered to address increasing the iron provided to students during the school day and impact on achievement in schools in the United States. Research has shown that the implementation of strategies for educating students about nutrition and physical fitness is not enough. Schools should address the macronutrient allowance provided to students, and then expand the educational approach to include why these nutritional changes may help the students cognitive development.

There is a lack of research to address that connection to school nutrition programs and cognitive health. This study addressed gaps in the research connecting a school nutrition program that offers iron-rich food to academic growth as measured by Lexile scores on a middle grades reading assessment. More research may benefit schools across the country in order to better inform school and system leaders how to best meet the needs of our high-risk low socioeconomic population.

CHAPTER 3

METHODOLOGY

Introduction

Research addressing socioeconomic status and student achievement has been prevalent for decades (Bellibas, 2015; Huang, 2015; Jenson, 2013; Jenson & Snider, 2013; Mather & Jarosz, 2014; Rawlinson, 2011; Tileston & Darling, 2008). The United States educational acts specifically address closing the achievement gap between economically disadvantaged children and their more economically advantaged peers. Nevertheless, the achievement gap between students from low- and high- income families continues to increase. Students who suffer from lower socioeconomic living conditions are less likely to succeed in elementary and secondary schools and to attend a higher education institution. As states address this issue, some strategies have shown to help lessen the gap. In addition to assigning high quality teachers, strong leadership, and parent and community involvement to low socioeconomic environments, Bellibas (2015) has highlighted the importance of "basic life needs" (p. 693) for students of poverty.

A comprehensive review of literature shows proper nutrition is important to brain health (Douong, Marin, & Villamor, 2015; Garkal & Shete, 2015; Halim, Speilman, & Larson, 2015; Ickovics, Carroll-Scott, Schwartz, Gilstad-Hayden, & McCaslin, 2014; Iqbal, et. al., 2015, Murray-Kob & Beard, 2007; Prado & Dewey, 2004; Priya et. al., 2016; Purtell & Gershoff, 2015). The brain of a teenager continues to grow and develop during adolescence. Cognitive pathways are reorganized and strengthened during middle and high school. School food and beverages make up 35% to 51% of total dietary intake of all children (Lucarelli et. al., 2014). However, school food programs do not regulate micro or macronutrients such as iron; rather, schools are required to regulate calories, saturated fat, and salt. According to the Guidelines of Adolescent Nutrition Services, teens need up to 11 milligrams a day of iron and 15 milligrams a day for menstruating females (Story & Stang, 2005). Unfortunately, school nutrition programs offer less than half of the daily requirement of iron. Therefore, schools may not be providing the nutrients required for brain health.

Based on the review of literature much of the recent research to address childhood nutritional needs and school nutrition programs has focused on reducing obesity and body mass index. These studies addressed the school lunch offerings compared to stringent nutritional criteria of portion size and calorie intake (Casselbury, 2016; DiSena, 2015; Greece, Kratze, DeJong, Cozier, & Quatromoni, 2015). Other research uncovered the impact of poor nutrition and student health on school attendance and grade retention in foreign countries but did not address cognitive function. Few recent studies were uncovered to address increasing the iron provided to students during the school day and its effect on achievement in schools in the United States. This study was designed to better understand the effect of increasing the iron offerings in one middle school nutrition program and determine if the menu change increased the Lexile growth in Reading scores of eighth grade students. This chapter will outline how archival data from the Georgia Milestone End of Grade Assessment (EOG) English language arts Lexile score was used to determine the impact of change of cognitive health. This chapter will include how students were selected and data were collected from the Georgia Department of Education administrative portal. Finally, this chapter will show how the data were analyzed based on overarching and sub-research questions.

The researcher has applied the Kotter's Eight Stage Process to Creating a Major Change (Kotter, 1996) to transforming the school nutrition program at MMS in Southeast Georgia to serving more iron rich food offering to students. The focus of this researcher's study was to impact student cognitive function; therefore, all eight-change strategies were used to lead a sustainable change in one schools nutrition program. For a detailed explanation for how Kotter's process was applied see the Theoretical Framework in Chapter 2.

Research Questions

The purpose of this study was to determine if there is a correlation between a middle school nutrition program and student Reading performance. Therefore, the overarching research question that guided this study asked: What is the relationship between student achievement growth as measured by Lexile score in reading and a school nutrition program? The research study was also addressed social economic status and sex in relationship to student achievement with the following research sub-questions:

1. What is the effect of school participation in an iron-rich school nutrition program on reading achievement as measured by Lexile scores before and after implementation while controlling for middle school student's socioeconomic status?
2. What is the effect of school participation in an iron-rich school nutrition program on middle school female students' reading achievement as measured by Lexile scores before and after implementation while controlling for their socioeconomic status?

3. Is there a meaningfully significant difference in Lexile scores between male and female middle school students who participate in an iron-rich school nutrition program before and after implementation while controlling for their socioeconomic status?

Research Design

This study utilized a correlational research design with a repeated measure component designed to collect and organize data on the Lexile growth of MMS students. Melton Middle School is a pseudonym to ensure the anonymous nature of the study. This method was selected because the researcher analyzed the relationship between an iron rich school nutrition program and Lexile growth before and after implementation of the new nutrition program. The analysis was employed to determine if the independent variable, iron rich food offerings, effected a change in the dependent variable, Lexile growth. Lexile measures were collected from the Georgia Milestone End of Grade Assessment for English language arts grade eight after the introduction of an iron rich school menu. Archival data representing Lexile scores for the same group of students for grade seven served as pre-intervention data set.

A transformational leadership framework has applied Kotter's Eight Stage Process to Creating a Major Change (Kotter, 1996). No modifications were made to the school nutrition program for year one, 2015, when the sample was in grade six; however, a school-wide staff book study of Eric Jenson's *Teaching With Poverty In Mind* did take place. In year two, 2016, when the sample was in grade seven, the principal/ researcher began implementing Kotter's eight steps through building a coalition, establishing a vision, planning menus, and sampling foods. In year three, 2017, when students were in grade eight, the school breakfast and lunch menus were defined and implemented, and iron rich food choices were promoted school-wide. Consistent reading instruction continued at the school with no new implementations, programs, or strategies in order to control variables.

Population and Sample

MMS has a population of approximately 680 students in grades sixth through eighth. The eighth grade class has approximately 225 students. The study described the Lexile growth of a maximum of 200 of these 225 middle school students ages 11-14. These eighth grade students were selected based on being present at MMS throughout the years of focus for the study, 2016 through 2017. These students made up one grade level at MMS. As the research had no control over student enrollment, this represented a non-random convenience sample utilizing data that were readily available to the researcher. The population contained subsets 50% males and 50% females, 60% low socioeconomic status students, 17% students with disabilities, and 38% Black, 50% White, 8% Hispanic and 4% Multi-racial students. Socioeconomic status was determined by the approved of free and reduced lunch applications. However, no students were directly involved in this study. The researcher had no interaction with the students in connection to the study and accessed data from the Georgia Department of Education website.

Instrumentation

To ensure validity and reliability, a standardized test, the Georgia Milestone End of Grade Assessment, was used to determine differences. Based on the results of Georgia Milestone End of Grade Assessment, the Georgia Department of Education provides the school with Lexile scores for each student. The Lexile® Framework for Reading is an educational tool that links text complexity and readers' ability on a common metric known as the Lexile scale. This is a normal school activity and is not something implemented for the sake of this study.

Research has shown that a change in diet makes a difference in academic achievement (Douong, Mora-Plazas, Marin, & Villamor, 2015). In particular, it is a menu that is rich in iron that is linked to higher academic performance. A school nutritionist had been employed by the school district to revise the breakfast and lunch menus with the focus on revising the food choices offered to students for the school year that was protein based and, thus, would increase the iron students are receiving in school meals. During the 2017 school year MMS students received more iron rich choices during the school day and these choices were made available more often during the week.

Data Collection

After being granted permission by the local school system and the Georgia Southern University Institutional Review Board (IRB), the researcher collected students' Lexile scores as reported by Georgia Department of Education regarding students' performance on the English language arts portion of the Georgia Milestone End of Grade Assessment. School administrators have access to their assigned school scores, both current and historic assessment data, through the Georgia Department of Education Administrative Portal. Data are released within two weeks of the assessment and available in the portal within four weeks. The researcher only had access to MMS data. The portal is equipped with search filters to select assessment years, strand, and demographics. The researcher first obtained a list of 2017 eighth graders who were present at MMS since fall 2015. Then the researcher collected the eighth graders 2016

Lexile scores when they were in seventh grade and, the eighth grade Lexile score for those same students at the end of 2017 school year. Selected 2016 and 2017 Lexile scores included gender, current grade, and socioeconomic demographics. Socioeconomic status is reported as a proxy measure in terms of yes or no. The data was exported from the portal for analysis. Only the scores of current eighth grade students that attended both years was used in the analysis.

Data Analysis

Student Lexile growth was examined from two waves of data gathered annually; 7^{th} grade Lexile and 8^{th} grade Lexile for the same sample of MMS students. Stratified subsets were also used to compare Lexile growth by gender and socioeconomic status. Prior to data analysis, data screening and assumption testing was conducted. Data were analyzed using SPSS to determine growth comparisons in Lexile scores for the same group of students from year 2016 to year 2017. Research sub-question one was answered by conducting a repeated measures analysis of covariance (RM ANCOVA) with students' socioeconomic status (yes, no) serving as the covariate and reading Lexile scores (Years 2016 and 2017) serving as the outcome. The second research sub-question was answered by conducting a RM ANCOVA of middle school female students' (Years 2016 and 2017) reading Lexile scores, with socioeconomic status (yes, no) serving as the covariate. The final research sub-question was answered by conducting a 2 (gender: male, female) x 2 (Years 2016 and 2017) factorial mixed-model ANCOVA, with Lexile score serving as the outcome and students' socioeconomic status (yes, no) serving as a covariate. Therefore the overarching sub question will be answered by the overall data analysis.

The data met requisite statistical assumptions, including normality, linearity, sphericity, homogeneity of error variance, and the homogeneity of regular coefficients, and thus, data analysis proceeded without making any adjustments to the data.

Limitations, Delimitations, and Assumptions

As with all studies, there was limitations to this study that may affect the generalizability of findings. There were limitations to the validity of this design based on the reliability of the student's school nutrition choices and the consumption of those choices. A small number of students in the non-randomized sample often brought their lunch to school and all of these students fell in the *not identified low socioeconomic subset*. The nutrition value of their lunch was not within the control of the study. Also, students who received school breakfast and lunch may not have selected the most iron rich choices and may not have eaten all of the serving on a given day; oftentimes, low socioeconomic students tend to select the most filling items and consume a great portion, if not all, of that offering.

Delimitations are often identified as choices the researcher had made, and this study is no exception. The study included a maximum of 200 MMS students, which limits generalizability. Also, the assessment used to obtain Lexile scores was administered by the Georgia Department of Education to all public middle school students in Georgia; it was assumed to be a valid and reliable instrument; however, no psychometrics are made available to school administrators. In addition, the study only included those students who attended MMS for the two years prior to the intervention, and the year of intervention. The data retrieved was provided to the researcher through the Georgia Department of Education administrative portal. The researcher only had access to MMS End of Grade Assessment data, therefore the findings represented one schools results.

Chapter Summary

The researcher used a correlational research design to collect data from the Georgia Milestone End of Grade Assessment from the Georgia Department of Education Administrative portal for pre and post intervention scores. The researcher determined Lexile growth over two waves of data for a sample of eighth grade students using archived data from grades seventh and eighth, looking also at socioeconomic status and gender subsets. The significance of this study is to inform schools and districts in efforts to reduce inequalities in both academic achievement and students' health. This research may also benefit schools across the country in methods to better inform school and system leaders how to best meet the needs of our high-risk low socioeconomic population.

CHAPTER 4

REPORT OF DATA AND DATA ANALYSIS

Introduction

This research study was designed to understand the effect of increasing the iron rich food offerings in one middle school nutrition program in Southeast Georgia, Melton Middle School (MMS), and determine if the menu change increased the Lexile growth in Reading scores of eighth grade students. The researcher applied the Kotter's Eight Stage Process to Creating a Major Change (Kotter, 1996) into transforming the school nutrition program at MMS to develop, implement, and promote more iron rich food offerings to students. The focus of this study was to impact student cognitive function through transforming a sustainable change in one schools nutrition program.

This chapter will discuss data collected to address research questions about reading achievement and nutrition. The research design analyzed archival data from the Georgia Milestone End of Grade Assessment (EOG) English language arts Lexile score in order to determine the impact of change. The data were concentrated to gender and socioeconomic subsets. Lexile data were collected from de-identified students and collected from the Georgia Department of Education administrative portal.

Research Questions

The purpose of this study was to determine if there is a correlation between a middle school nutrition program and student Reading performance. Therefore, the overarching research question that guided this study asked: What is the relationship between student achievement growth as measured by Lexile score in reading and a school nutrition program? The research study also addressed social economic status and sex in relationship to student achievement with the following research sub-questions:

1. What is the effect of school participation in an iron-rich school nutrition program on reading achievement as measured by Lexile scores before and after implementation while controlling for middle school student's socioeconomic status?
2. What is the effect of school participation in an iron-rich school nutrition program on middle school female students' reading achievement as measured by Lexile scores before and after implementation while controlling for their socioeconomic status?
3. Is there a meaningfully significant difference in Lexile scores between male and female middle school students who participate in an iron-rich school nutrition program before and after implementation while controlling for their socioeconomic status?

Research Design

This study was a correlational research design with a repeated measure component designed to collect and organize data on the Lexile growth of MMS students. This method was selected because the researcher analyzed the relationship between an iron rich school nutrition program and Lexile growth before and after implementation. The analysis determined if the independent variable, iron rich food offerings, effected a change in the dependent variable, Lexile growth. Lexile measures were collected from the Georgia Milestone End of Grade Assessment for English language arts grade eight after the introduction of an iron rich school menu. Archival data representing Lexile scores for the same group of students for grade seven served as pre-intervention data set.

A transformational leadership framework applied Kotter's Eight Stage Process to Creating a Major Change (Kotter, 1996). No modifications were made to the school nutrition program for year one, 2015, when the sample was in grade six; however, a school-wide staff book study of Eric Jenson's *Teaching With Poverty In Mind* did take place. In year two, 2016, when the sample was in grade seven, the principal/ researcher began implementing Kotter's eight steps through building a coalition, establishing a vision, planning menus, and sampling foods. In year three, 2017, when students were in grade eight, the school breakfast and lunch menus were defined and implemented, and iron rich food choices were promoted school-wide. Consistent reading instruction continued at the school with no new implementations, programs, or strategies in order to control variables.

Demographic Profile of the Respondents

At the time of the data collection MMS had a population of 626 students in grades sixth through eighth. The eighth grade class had 189 students that attended both years of the study. These eighth grade students were selected based on being present at MMS throughout the years of focus for the study, 2016 through 2017. These students made up one grade level at MMS. As the research had no control over student enrollment, this represented a non-random convenience sample utilizing data that was readily available to the researcher. The population contained subsets 94 or 50% males and 95 or 50% females, 104 or 55% low socioeconomic status students, 25 or 13% students with disabilities, and 52 or 27% Black, 117 or 62% White, 11 or 6% Hispanic and 9 or 5% Multi-racial students. Socioeconomic status was determined by the approved of free and reduced lunch applications. However, no students were directly involved in this study.

The researcher had no interaction with the students in connection to the study and accessed data from the Georgia Department of Education website.

Findings

Nutrition, Lexile, and Socioeconomic Status

The first research sub-question was answered by conducting a repeated measures analysis of covariance (RM ANCOVA), examining student Lexile scores (Years 2016 and 2017) while controlling for the effect of students' socioeconomic status (yes, no). Question one addressed the effect of an iron rich school nutrition program on Lexile growth. The study controlled for socioeconomic status as a proxy measure determined by school Free and Reduced Lunch applications. In the socioeconomic subset, Yes represents students who qualified for Free or Reduced lunch and have low socioeconomic status, and No represents students who did not qualify for Free and Reduced Lunch students and have average or above socioeconomic status.

Findings indicated that the iron rich intervention had a practically significant effect on Lexile scores. Practical significance indicates that the difference in Lexile from Year 1 to Year 2 is a large enough value for practical use. After controlling for the influence of socioeconomic status ($\eta^2 = .157, p = 001$), Lexile growth from 2016 to 2017 was statistically and practically significant, $F_{(1,187)} = 52.672, p = 0.0001, \eta^2 = .220$, indicating that there was an increase in Lexile scores between Years 2016 and 2017.

Table 1

Descriptive Statistics of Lexile Scores for the 2015-2016 and 2016-2017 Academic Years of All Students

Lexile Score by Year	*M*	*M* $_{adjusted}$ (Std. Error)	*SD*	*N*
2016 Lexile Score	1116.93	1116.93 (130.19)	182.70	189
2017 Lexile Score	1221.24	1221.24 (12.69)	188.91	189
Difference	104.31		6.21	0

The average Lexile growth for all students after the implementation of the iron rich school lunch intervention was 104.31. According to the research, the expected growth for one year in secondary grades ranges from 53 to 64 points (Allington, McCuiston, & Billen. 2015; Willianson, 2006), MMS Lexile growth is above the expected average one year Lexile growth for a secondary level students. The lower standard error in 2017 also represents that the mean more accurately represents of the population.

Nutrition, Lexile, Socioeconomic Status, and Females

Data were submitted to a RM ANCOVA to answer the second research sub-question examining female student Lexile scores (Years 2016 and 2017) while controlling for the effect of students' socioeconomic status (yes, no). Question 2 addressed the effect of an iron rich school nutrition program on female students Lexile growth. The study controlled for socioeconomic status as a proxy measure determined by school Free and Reduced Lunch applications. In the socioeconomic subset, Yes represents students who qualified for Free or Reduced lunch and have low socioeconomic status, and No represents students who did not qualify for Free and Reduced Lunch students and have average or above socioeconomic status.

Findings indicated that the iron rich intervention can be attributed to the increase in female students Lexile scores. After controlling for the influence of socioeconomic status ($\eta^2 = .120, p = 001$), Lexile growth from 2016 to 2017 was statistically and practically significant, $F_{(1,93)} = 19.852, p = 0.0001, \eta^2 = .176$, indicating that there was an increase in female students Lexile scores between Years 2016 and 2017.

Table 2

Descriptive Statistics of Lexile Scores for the 2015-2016 and 2016-2017 Academic Years of Female Students

Lexile Score by Year	*M*	*M adjusted (Std. Error)*	*SD*	*N*
2016 Lexile Score	1134.47	1134.47 (19.18)	195.36	95
2017 Lexile Score	1227.32	1227.32 (17.67)	182.01	95
Difference	92.85		13.35	0

The average Lexile growth for female students after the implementation of the iron rich school nutrition program was 92.85. MMS female students Lexile growth is above the expected average one-year Lexile growth for a secondary level student which ranges from 53 to 64 points. The lower standard error in 2017 also represents that the mean more accurately represents of the population.

Nutrition, Lexile, Socioeconomic Status, and Gender

The final research sub-question was answered by conducting a mixed-model between 2 (gender: male, female) x 2 (Years 2016 and 2017) factorial mixed-model ANCOVA, in which an iron rich school nutrition program served as the between-subjects factor, Lexile scores (2016 and 2017) served as the within-subjects factor, and students' socioeconomic status (yes, no) served as the covariate. Question three addresses the effect of an iron rich school nutrition program on male and female students measured by Lexile growth. The study controlled for socioeconomic status as a proxy measure determined by school Free and Reduced Lunch applications. In the socioeconomic subset, Yes represents students who qualified for Free or Reduced lunch and have low socioeconomic status, and No represents students who did not qualify for Free and Reduced Lunch students and have average or above socioeconomic status.

Results revealed that the gender (male, female) x year (2016, 2017) interaction did not have a meaningfully significant difference on Lexile score change, (η^2 =.01, p = .27), indicating that gender did not moderate the change in Lexile scores across 2016/ 2017. Individual main effects were interpreted next. The within-subjects main effect was statistically and practically significant, $F_{(1,186)} = 52.87, p = 0.0001, \eta^2 = .221$, after controlling for the effect of socioeconomic status ($\eta^2 = .157, p = 001$). The gender main effect did not reach significance ((η^2 =.005, p = .34).

Table 3

Descriptive Statistics of Lexile Scores by Gender and Year

Lexile Score	Male			Female		
	M	*M adjusted (Std. Error)*	*SD*	*M*	*M adjusted (Std. Error)*	*SD*
2016	1099.20	1099.59 (18.67)	189.35	1134.47	1134.09 (18.57)	195.36
2017	1215.11	1215.54 (18.03)	196.42	1227.32	1226.89 (17.94)	182.01
Difference	115.91			92.85		

The average Lexile growth for male students after implementation of the iron rich school nutrition program was 115.91. The average Lexile growth for female students after the implementation of the iron rich school nutrition program was 92.85. MMS male and female students one year Lexile growth is above the expected average Lexile growth for a secondary level student which is 53 to 64 points. Although both males and females showed growth, female students' Lexile scores were consistently higher when compared to males.

Therefore, the overarching research question that guided this study asked: What is the relationship between student achievement growth as measured by Lexile score in reading and a school nutrition program? There is a direct and significant relationship between student achievement and school nutrition. An iron-rich school nutrition program does increase student achievement as represented through Lexile growth in pre and posttest data.

Chapter Summary

The chapter presented the research findings in terms of reading scores before and after the implementation of an iron rich school nutrition program. The statistical analysis included mean Lexile scores for eighth grade students controlling for socioeconomic status and analysis gender subsets. Overall, the findings showed an above average Lexile growth after the implementation of an iron rich school nutrition program. There was no significant difference in gender outcomes, however overall the students Lexile score were 104 points higher, males 115 points higher, and females 92 points higher from Year 1 to Year 2. The average expected Lexile growth for one year in secondary education is 53 to 64 points. MMS students exceeded that average by 30 to 40 points. Concluding that a iron rich school food program had a significant effect on Lexile scores at MMS.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

Summary

The United States No Child Left Behind Act (2002) specifically addressed closing the achievement gap between economically disadvantaged children and their more economically advantaged peers as one of the goals of the act. As the government reauthorizes its educational act, most recently Every Student Succeeds Act (2015), the economically disadvantaged students continue to be a prioritized subgroup. Nevertheless, the achievement gap between students from low- and high-income families continues to increase. “As income inequality continues to grow in the United States, the achievement gap becomes an even more critical issue than it was in the past” (Huang, 2015, p. 5). Students who suffer from lower socioeconomic living conditions are less likely to succeed in elementary and secondary schools and to attend a higher education institution. The low socioeconomic student achievement at Melton Middle School (MMS) was below state expectations leading school administration to conduct a faculty book study on *Teaching With Poverty in Mind* by Eric Jenson (2009) to learn strategies for educating students of poverty.

As states address this issue, some strategies have shown to help lessen the gap. High expectations, strong school leadership, effective teachers, and parent and community involvement have been identified to impact achievement for students of poverty. In addition to assigning high quality teachers to low socioeconomic environments, Bellibas highlighted the importance of “basic life needs” (p. 693) for students of poverty. Other researchers have detailed that nutrition not only showed health improvement, but also showed an “increase of school enrollment, cognition, labor capacity, productivity, and earnings in adults" (Halim, Spielman, & Larson, 2015, p. 13). The principal/ researcher concluded from the reading that MMS school nutrition program needed to be addressed to meet the cognitive needs of all students, especially the students of poverty as a means by which student achievement could be improved.

Reducing disparities, especially by reducing gaps in nutrition, will not only improve conditions for lower income children, but will also support educational attainment by creating a well-qualified workforce (Nurse, Dorey, Yoa, Sigfrid, & Yfantopolous, 2014). Poverty and its related risk factors are damaging on the physical, social-emotional, and cognitive well-being of children and their families. Data from the Infant Health and Development Program showed that 40% of children living in chronic poverty had deficiencies in at least two areas of function, including language and emotional responsiveness (Jenson, 2009). Socioeconomic status is strongly associated with a number of indicators of a child's cognitive ability, including achievement tests, grade retention, and literacy skills.

In this study the principal/researcher used the steps to Kotter's Eight Stage Process for Creating a Major Change (1996) to implement an iron rich food program in one middle school. The steps included building a coalition for change to changing the culture for sustainability. The coalition research and discussion lead the way to the hiring of a full time nutritionist for the school system. The nutritionist researched menu items that had more protein and iron. Before addressing the school nutrition offerings, only seven out of 131 items available for the MMS Food and Nutrition staff to build the schools breakfast and lunch menus contained half of the recommended daily intake of iron, the other items contain far less or no iron at all. According to the Guidelines for

Adolescent Nutrition Services, children ages 9 -13 years of age should consume 8 milligrams a day (mg/d) of iron; by ages 14-18 years the recommended daily intake increases to 11 mg/d for males and 15 mg/d for females (Story & Stang, 2005). The goal of the coalition was to build and serve at least one menu item a day that contained at least half of the recommended amount of iron. The food offering goal amount was 5 milligrams of iron. In some cases a student could chose an iron-rich breakfast and lunch, therefore receive the daily recommended allowance of iron.

The focus of the researcher's study was to determine if a nutritional change of a more iron-rich school nutrition program would affect cognitive function measured through Lexile growth. Year 2016 Lexile scores collected from the Georgia Milestone End of Grade Assessment for English language arts were compared to the implementation year (2017) results from the same assessment. The same cohort of students were used for the pre- and post-implementation data. The data were provided to the researcher from the district school system test coordinator void of any student identification information. Data were analyzed using SPSS to determine growth comparison in Lexile scores for year 2016 and year 2017 analyzing gender and controlling for socioeconomic status.

Analysis of Research Findings

The average Lexile growth for all students after the implementation of the iron rich school lunch intervention was 104.3 points after controlling for socioeconomic status. The results indicated that the iron rich intervention had a significant effect on Lexile growth controlling for socioeconomic status. Expected Lexile growth from seventh to eighth grade is 64 Lexile points (Williamson, 2006); however, an individual student's starting Lexile affects their individual growth. According to Williamson's white paper on expected growth, average Lexile growth gradually reduces as the grade level increases. More complex texts in higher grades may result in lower growth averages. Some national benchmarks expect an annual growth of 163 Lexile levels in elementary school and an annual growth of 53 Lexile levels in secondary grades (Allington, McCuiston, & Billen, 2015). MMS Lexile growth to 104.3 was above the expected average one-year growth for secondary level students.

The data also showed that the iron rich intervention can also be attributed to the significant increase in female students Lexile scores. After controlling for socioeconomic status, female Lexile growth was 92.8 points, which is above expected growth of 53 to 64 points. Research on adolescents has shown that they consume inadequate amounts of vitamins and minerals, stressing low consumption of vitamin A and E, iron, and calcium (Oser, Beck, Alvarado, & Pang, 2014). The study stressed the deficiency was more pronounced in females than males. The same research suggested that milk is the primary component of school lunch responsible for participants consuming protein, vitamin A, and calcium (Oser, et al., 2014). Adolescent girls suffer from poor body image as well as iron loss during menses, both resulting in poor nutritional outcomes.

The average Lexile growth for male students was 115.9 points and the average Lexile growth for female students was 92.8 points. Even though both males and females Lexile scores grew after implementation, one gender did not grow more significantly than the other gender. Poor nutrition is more likely to harm brain development if the deficiency occurs during a time when neural development is high (Prado & Dewey, 2014). "Environmental impact is thought to be one of the primary mechanisms of brain plasticity, allowing the brain to organize itself to adapt to the environment and reorganize itself to recover from injury during development" (Prado & Dewey, 2014, p. 268). The adolescent brain is undergoing an important developmental reorganization; therefore, nutrition provided from the student's environment is key.

The MMS iron-rich school nutrition program was only in effect for one year. Previous research that found results in one year were through direct iron supplements. Murray-Kolb and Beard published a study in which young women participated in a double-blind placebo intervention for 16 weeks. After treatment with iron supplements the CogAt scores increased. This researcher believes that MMS study's results were also related to the promotion and school-wide focus on "smart food" and student buy-in. Even though eighth grade students are not expected to have significant Lexile growth due to the increased text complexity, MMS eighth graders had a significant growth.

Discussion of Research Findings

The mean reading score of a student can be predicted by the collected rates of childhood poverty. The National Assessment of Educational Progress (NAEP) reports that 80% of low-income fourth graders are not proficient in reading. Proficiency on reading scores for the five major ethnic groups in the United States indicate that adequate progress is not being met over time for those ethnic groups with the highest percentage of children in poverty. The Ramsey and Spearling 2015 research showed that reading lengthy text posed a significant challenge to readers in terms of comprehension (Ramsay & Sperling, 2015). Students of poverty have limited experiences when it comes to reading informational text. Eighth grade students in the study had the longest passages and had difficulty with comprehension. Therefore, prior knowledge, or lack of, impacts comprehension. Longer passages are even more difficult to comprehend possibly because of cognitive ability and loss of interest in the topic. Even with exposure to quality care, many children may still not be healthy and developmentally ready to learn. Based on the Kotter approach to building a team to address school nutrition at MMS, the district nutrition director hired a full-time nutritionist to support the school system. The nutritionist has been working on changing menus for all schools in the district to increase the amount of protein choices, therefore, increasing iron. This has been a gradual process but a positive one as a result of this research.

Unfortunately, children who are not well-nourished are at risk for weakness in their ability to form cognitive, motor, and socioemotional skills. Healthy cognitive, motor, and socioeconomic abilities are strongly linked to academic achievement and economic productivity. Therefore, cohesive strategies addressing the many risk factors, particularly nutrition, are needed to help to reduce inequality and promote cognitive, motor, and socioemotional development in underprivileged children, affirming that all children have the opportunity to achieve their developmental potential (Prado & Dewey, 2014). Therefore, the relationship between nutrition and the brain should translate to school nutrition programs in the United States. The new Secretary for the United States Department of Agriculture is former Georgia Governor Sonny Perdue. Secretary Perdue has already addressed school nutrition programs by reducing restrictions on salt, white bread, and whole milk. Although these changes may impact the tastes of recipes made in schools, Perdue's actions will not impact student achievement, according to research. Other initiatives have also focused on providing students more fresh fruits and vegetables from local farms or school gardens. Again, the concept is valid but, besides vitamin A and C, not much nutrition can be gained that will impact brain health.

Students of poverty are entering school unprepared for the increased rigor imposed in reading, and may also not be healthy enough to begin to rise to the challenges. Georgia has identified reading and Lexile growth as an achievement criteria for each individual school and school system. The state has also set progressively increasing performance targets for all students, regardless of the changing demographics of the state or community. Unfortunately, students of poverty have very limited experiences and cannot connect to what they are reading. It might be better to build students' background knowledge rather than inferences, character motivation, and summarizing. Classroom strategies, computer assisted instruction, and classroom libraries may all be less effective when delivered to students that are unhealthy and hungry.

According to the National School Lunch Program 2016-2017 data, the nation's schools served 17 million breakfasts and 5 billion lunches (2017). The cost of producing a school meal differs from one state and school system to the next due to regional variations in food, labor, fuel costs, school equipment, and infrastructure. In April 2008, USDA released its *School Lunch and Breakfast Cost Study-II*, which examined the cost of producing a school meal during school year 2005-06. The study found that, on average, the full cost to produce a school lunch was $2.91, exceeding the free lunch subsidy, then the cost would be $2.495. Forty-eight percent of the cost to produce school nutrition programs is for labor and benefits. Thirty-seven percent of the cost goes to food, and the remaining fifteen percent is for supplies (School Nutrition Association, 2017). Lunch at MMS costs $1.50, well below the national average. Throughout this study the district school nutrition program did not raise lunch prices and do not anticipate raising prices in the coming year. The director and nutritionist were diligent in locating vendors and recipes that would meet the iron-rich expectation and stay on budget, however difficult.

Participation in the school nutrition program could be an important element in providing nutrition to children at school as well as nutritional quality. Educating students, parents, and school administrators about the benefit of school nutrition programs could promote participation. The Health and Nutrition Examination Survey and the Nationwide Food Consumption Survey have shown that large portions of school-aged children in the United States do not consume the recommended daily amounts of some nutrients, especially iron, magnesium, vitamin B, vitamin A, and calcium. Therefore, school nutrition programs are an established program that can be tailored to provide more healthy options to impact cognitive function. The National School Lunch Program requires two ounces of protein be served to grades nine through twelve and one ounce of protein to younger students (Casselbury, 2016). Schools Lunch Programs may rely on students receiving protein at other times of the day, but for many students of poverty, they are not.

Children are at school for almost half of their waking hours and most eat two meals a day in the school setting (Ball, Kavarik, & Leidy, 2015). For this reason, school is a valuable place to initiate nutritional behavior changes. The results indicated that budget had a large impact on the prioritization of menu selections. Overall, administrative attitude, motivation, and support are important determinants of school nutrition practices (Lucarelli, et al., 2014). In order to create this type of program, schools should develop short-term and long-term goals to address health, safety, and achievement needs of children (Oser, et al., 2014). Children need to be educated on what healthy choice are, and an improved health-focused setting makes those choices easier (Ball, Kavarik, & Leidy, 2015). At MMS "smart food" signs were placed on menu signs to direct children to the most iron-rich food choice that day. The principal used the school news show to explain what was happening with the lunch menu and the overall goal of increasing brain health. Students were allowed to taste new items, and were asked their opinion and suggestions for other items. Therefore, school leadership can be seen as another key factor in the change by recognizing and supporting the need to address student nutritional health.

Conclusions

Few studies have examined the influence of macronutrient health on educational outcomes, even though it is widely recognized that minerals are critical to neurocognitive development (Douong, Mora-Plazas, Marin, & Villamor, 2015). Educational leaders have a moral obligation to promote health and social justice for all students. Therefore, the purpose of this study was to determine if an intervention in terms of an iron-rich school menu can increase academic achievement and, thus, level the playing field for student health and student achievement through school nutrition programs.

As a result of the findings from this study, one goal of the MMS leadership was to change and improve school nutrition in such a way that it can expand and last for many years to come. The focus of this researcher's study was to impact student cognitive function as demonstrated through Lexile scores in reading. Therefore, all eight-change strategies were used to lead a sustainable change in one schools nutrition program. The researcher chose Kotter's Eight Stage Process (1996), and all eight steps were applied.

There is a lack of research to address the connection to school nutrition programs and cognitive health. This study addressed gaps in the research connecting a school nutrition program that offers iron-rich food to academic growth as measured by Lexile scores on a middle grades reading assessment. A one year intervention of an iron rich menu showed significant growth in student reading as determined by Lexile scores of 8th grade students at MMS based on pre- and post-data from the state assessment. More research over time and of multiple grades will benefit schools across the country in order to better inform school and system leaders how to best meet the needs of the ever increasing high-risk low socioeconomic student population.

Implications for Practice

A majority of the children who live in poverty suffer from malnutrition and approximately half of these children suffer from iron deficiency. Iron deficiency has been linked to impaired immune systems, changes in metabolism, and decreased cognitive function. A targeted population of infants, children, and menstruating females are at the highest risk for iron deficiency anemia. The United States and World Health Organizations have had success with interventions to address malnutrition that include: salt iodization, iron fortification, and educational interventions to address food sources.

Proper nutrition is important to brain health. The brain of a teenager continues to grow and develop during adolescence. Cognitive pathways are reorganized and strengthened during middle and high school. School food and beverages make up 35% to 51% of total dietary intake of children; these percentages are even higher for children of poverty. However, school food programs do not regulate micro or macronutrients such as iron; rather, schools are required to regulate calories, saturated fat, and salt. According to the Guidelines of Adolescent Nutrition Services, teens need up to 11 milligrams a day of iron and 15 milligrams a day for menstruating females. Unfortunately, school nutrition programs offer less than half of the daily requirement of iron. Therefore, schools may not be providing the proper nutrients required for brain health.

One of the lasting implications of this study was the addition of a school district nutritionist. This position was created in 2016 as a direct result of this study's coalition formed to improve the nutrition program at MMS. As a result of the research and conversations with the district Food and Nutrition Director it was determined that a full time nutritionist was needed to look at the school breakfast and lunch menus district wide. This individual not only addressed the protein and iron offerings to MMS but the district as a whole. Menus were not planned in the past with a focus on protein and iron, rather they were designed based on the USDA guidelines of low fat, low salt, and low sugar. Cost and student preference was also a major factor in the past, but food tasting and new healthier products were not explored.

Another interesting implication was that the vendors had to change their approach when selling product to the school system. Vendors had to modify their own recipes and research more nutritional options for the school system or they would lose the bid. High protein was a concept vendors could understand. The requirements, per the Dietary Reference Intake, indicate that children are in need of .95 grams of protein per pound of weight as opposed to .36 grams of protein per pound for adults (Casselbury, 2016). Therefore, a student who weighs one hundred pounds should be consuming 95 grams of protein a day or 3.35 ounces. Casselbury discussed that different foods contain different amounts of protein, but as a rule, the National School Lunch Program requires two ounces be served to grades nine through twelve and one ounce to younger students (Casselbury, 2016). The Food and Nutrition Department strived for 20 grams of protein a meal. In most cases a high protein product also contained high iron. On several occasions, the Food and Nutrition Staff would develop their own recipe that met the nutritional and cost requirement to be served to our students. For instance, our students asked for spaghetti, but vendors could not provide a product the system could afford with the protein and iron requirements requested by the nutritionist. The district then created a recipe that did meet those expectations. The vendor product had less than 15 grams of protein and less than 3 mg of iron. The local system recipe had over 17 grams of protein and over 5 mg of iron.

Another implication of the study was the change in student perception of food as nourishment for the brain and not just the body in general. The school-wide discussion of eating healthy for your brain was addressed on the school news show and from teachers and staff. Cafeteria staff would remind students to select the "smart food" choice if they had a test coming up. Teachers would tell students to make a good choice at lunch since they had a big project due. The cafeteria staff, students, and administration discussed the menus for the 2017 state assessment days. Students requested grits bowls, parfaits, beef nachos, spaghetti, and meatball subs. The students having a voice in the process gave them confidence during those stressful testing days. Kotter's (1996) step of empowering broad based action to illuminating barriers represents all members working toward the same goal. The district, cafeteria, students, and staff were promoting and talking about good nutrition for cognitive health.

This research was important because schools purchase and implement several programs to address low achievement but are not addressing the brain health and cognitive function of its students. The researcher was also able to determine that improved achievement performance of the low socioeconomic population at MMS had a relationship to increasing the amount of iron provided to all students during breakfast and lunch. The impact on the cognitive function of the students informed efforts to reduce inequalities in both academic achievement and student health. The research also benefits schools across the district in order to better inform school and district leaders how to best meet the needs of high-risk low socioeconomic population.

Recommendations for Future Research

This study focused on one year implementation with pre and posttest data. The researcher would suggest that multiple years of data be collected to look at the long term effect of an iron-rich school nutrition program. Research has shown that nutrition has a major effect on brain health (Garkel & Shete, 2015; Prada & Dewey, 2014). One year may have limited the impact reported for potential growth. A long-term study on improving nutrition in schools should yield powerful information on nutrition's impact on reading achievement through Lexile growth. Another approach would be to collect archived data before implementation to compare Lexile growth, as opposed to pretest posttest gains. Comparing growth within years without nutritional intervention to growth within years of iron-rich interventions may yield more information. A broader approach would also be to collect data from multiple grades. Research revealed that 3rd and 5th grades are key years for reading readiness (Hiebert, 2015). Studying a variety of grades would also reveal the grade bands in which iron rich nutrition intervention would have the greatest impact. Even as the adolescent brain is reorganizing, elementary school students' brains are still developing and may show benefits from a school-wide iron-rich school nutrition program.

This study's original focus was to address the nutritional needs of students of poverty. The researcher would recommend more health studies related to the low socioeconomic student populations. This research did not attempt to evaluate blood samples to determine if the low socioeconomic population at MMS was malnourished or iron deficient. It is difficult to have invasive studies; however, blood tests to determine iron deficiencies would be very valuable. Most malnutrition studies connected with the cognitive health of children were conducted in other countries (Garkal & Shete, 2015). Further research addressing the effect of iron-rich food on malnutrition and academic outcomes would influence educational leaders to address those specific nutritional needs for the students.

Impact Statement

The lasting effect of this study on MMS is the powerful shift in how the school as a whole looks at nutrition. The staff considers whether a student of poverty has had breakfast that morning or dinner the night before. Our students are more aware of the choices they are making at breakfast and lunch. They may still make some poor choices, but a lasting impact has been made on types of food and why healthy items are being served. The school district has completely changed their vision for how they feed our students. The district wide menu changes were implemented in every school. This study started at MMS but has spread to sixteen other schools.

The researcher has worked with students for over 25 years and has struggled to identify the means that will level the playing field for students of poverty. With only thirty-seven percent of the school systems Food and Nutrition Programs limited budget going to food, more funding is needed in order and serve students more nutritious iron-rich food choices. The researcher strongly believes that feeding our children nutritious meals, at any age, will make a difference in the cognitive health of all students. It is unfortunate that health organizations and educational leaders have not collaborated more on this topic. It is the researcher's desire that this study is a starting point for a standard practice of planning and serving iron-rich school meals to every student every day.

Disseminations of Findings

The researcher will first share the results of the study on the local level with the coalition formed to address the issue of nutrition. The coalition included district and school cafeteria staff, teachers, student, and parents. Kotter's steps conclude with consolidating gains, producing more change, and anchoring the culture. The principal/ researcher plans to share the findings with all parents through the monthly school newsletter. The coalition could build a fact sheet to share the steps taken and information gained throughout the process. The principal will share the information with students and staff in an effort to emphasize the importance of nutrition for brain health and to build sustainably.

On the district level the researcher is required to provide the school system the results of the study. However, the researcher plans to partner with the Food and Nutrition Department to present the study to the School Board. The researcher intends to recognize the school cafeteria manager, the school system nutrition director and nutritionist in order to validate their efforts toward improving the school lunch programs in the district. The study will also be shared with the district social media director as a post on the district Facebook page. The study will be spotlighted as a "whole child" approach to address student needs through nutrition and cognitive health.

The researcher will also share information outside the school district. The Nutrition Director plans to publish an article in their regional newsletter. This publication is shared with sixteen school systems. The information could then be recognized by state school nutrition leaders for further dissemination. The researcher has contacted individuals with the US Department of Agriculture and Georgia School Nutrition Department about the study and they have expressed interest in the results. Therefore, the researcher will be providing these organizations with the concluded study. The Georgia Association of Education Leaders and the Professional Association of Georgia Educators have showed interest in having the study presented at their state conferences.

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APPENDIX A

MELTON MIDDLE SCHOOL LUNCH MENU CHANGES BEFORE AND AFTER IMPLEMENTATION

Appendix A

Menu Items Replaced with More Iron-Rich Items in 2016-2017

Pork BBQ sandwich (Brand B)	**BBQ sandwich (District Recipe)**
Protein – 25.00 grams per serving	Protein – 29.07 grams per serving
Iron – 2.74 milligrams per serving	Iron – 3.10 milligrams per serving

Pepperoni Pizza (Brand A)	**Pizza (Brand N)**
Protein – 20.00 grams per serving	Protein – 20.0 grams per serving
Iron – 1.80 milligrams per serving	Iron – 2.70 milligrams per serving

Spaghetti with Meatballs (Brand T&E)	**Spaghetti with Meat Sauce (District Recipe)**
Protein – 14.87 grams per serving	Protein – 17.69 grams per serving
Iron – 2.49 milligrams per serving	Iron – 5.41 milligrams per serving

Spicy Chicken Strips (Brand H)	**Spicy Chicken Strips (Brand H)**
Protein – 13.93 grams per serving	Protein – 19.59 grams per serving
Iron – 1.99 milligrams per serving	Iron – 2.05 milligrams per serving

Breakfast

Whole Grain Honey Bun (Brand F)	**Ultimate Breakfast Round (Brand H)**
Protein – 4 grams per serving	Protein – 6 grams per serving
Iron – 1.8 milligrams per serving	Iron – 3.6 milligrams per serving

New Iron-Rich Menu Items Added in 2016-2017

Beef Soft Tacos w/ Black Beans (District Recipe)
Protein – 30.29 grams per serving
Iron – 5.37 milligrams per serving

Fish Sandwich w/ Cheese and Potato Wedges (Brand H)
Protein – 15.09 grams per serving
Iron – 2.45 milligrams per serving

Brunswick Stew w/ Grilled Cheese Sandwich (District Recipe)
Protein – 33.02 grams per serving
Iron – 6.11 milligrams per serving

Meatball Sub and Side Salad (Brand H)
Protein – 25.67 grams per serving
Iron – 2.81 milligrams per serving

Double Cheeseburger w/ Broccoli Salad (Brand H)
Protein – 38.60 grams per serving
Iron – 5.82 milligrams per serving

Salisbury Steak w/ Lima Beans and Mashed Potatoes (Brand H)
Protein – 25.57 grams per serving
Iron – 4.93 milligrams per serving

Breakfast

Greek Yogurt Parfait w/ Blueberries (District Recipe)
Protein – 10 grams per serving
Iron – 8.40 milligrams per serving

Grits, Eggs, and Turkey Sausage Bowl (District Recipe)
Protein – 18 grams per serving
Iron – 5 milligrams per serving