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## Student Nutrition and Academic Achievement

### Abstract

Proper nutrition that abides by United States Dietary Guidelines is critical in the cognitive, behavioral, emotional, and physical functioning of students. Food and drink choices that students make are heavily based on their preferences and what is available to them. Students who consume balanced, nutrient dense food and drink perform better in areas of participation, behavior, attendance and get their assigned tasks done more completely than students who do not eat well. Young people of today will be functioning members of society in the future so equipping them with proper education and skills for success is a critical role that educators must capitalize on, however, improper nutrition often poses a serious barrier to equipping students with the necessary tools and skills for success.

### Document Type

Thesis

### Degree Name

MS in Mathematics, Science, and Technology Education

### First Supervisor

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### Second Supervisor

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Student Nutrition and Academic Achievement

By

Lindsey M. Dodsworth

Submitted in partial fulfillment of the requirements for the degree

M.S. Mathematics, Science and Technology Education

Supervised by

Dr. Diane Barrett and Dr. Bernard Ricca

School of Arts and Sciences

St. John Fisher College

April 2010

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Abstract

Proper nutrition that abides by United States Dietary Guidelines is critical in the cognitive, behavioral, emotional, and physical functioning of students. Food and drink choices that students make are heavily based on their preferences and what is available to them. Students who consume balanced, nutrient dense food and drink perform better in areas of participation, behavior, attendance and get their assigned tasks done more completely than students who do not eat well. Young people of today will be functioning members of society in the future so equipping them with proper education and skills for success is a critical role that educators must capitalize on, however, improper nutrition often poses a serious barrier to equipping students with the necessary tools and skills for success.

### Student Nutrition and Academic Achievement

The purpose of this paper is to examine relationships between nutrition and how it affects student success in school. Nutrition from food is critical for both physical and mental function and growth. National guidelines exist which regulate what constitutes adequate nutrition to support the body, and these guidelines have been at least partially integrated into most school curriculums, as well as food and wellness policies. Although adequate nutrition is critical for the body and mind to function, it is less attainable by some students due to a variety of factors, such as socioeconomic status, cultural barriers, and specific preferences. Many of the academic and behavioral obstacles that students face in the classroom are fueled by inadequate nutrition and lack of understanding about what nutrition is and its importance. There are many actions that can be taken in attempts to ameliorate the issues of nutrition illiteracy and misunderstandings. These actions rely on central themes such as collaboration, creativity, and patience. Attempting to fix the issue of majorities of student populations suffering from obesity, eating disorders, or undernourishment is critical in the quest for advancements in all areas of school achievement and the assurance of bright futures for all students.

## Literature Review

A number of factors significantly impact student achievement on local, state-wide, and national assessments. This review of the literature has analyzed the current state of adolescent nutrition, the impact of nutrition on student achievement, barriers to good nutrition that adolescents face, and effective methods of combat against the barriers. Adequate performance in school is critical for the future state of American society as a whole, and researchers have found links between good nutrition, emotional health, and school performance. Research has been conducted in specific areas of nutrition and how students' nutritional choices are impacted by their environment, and this research has affected the creation of, successes, and failures of policies which have been implemented in school districts throughout the country.

### *Adolescent Health*

According to Fulkerson, Kubik, and Lytle (2004), unhealthy dietary practices among children and adolescents had been linked to serious health risks, such as childhood obesity and juvenile diabetes. Research conducted by the Youth Risk Behavior Surveillance System had shown the number of children and adolescents who are not eating the recommended daily amounts of fruits and vegetables to be 76.1%, with 82% not drinking the daily recommended amount of milk (Massey-Stokes, 2002). Dake, Fahlman, Martin, and McCaughtry (2008) found that in the United States, the occurrence of children who are overweight or obese had doubled between 1980 and 1999, and this doubling directly correlated with a decline in overall quality of diet. In the same study, the researchers found that adolescents who carry extra weight are 80% more likely to be overweight adults who have one or more risk factors for chronic disease (Dake, et al.,

2008). According to Casazza and Ciccazzo (2006), there had been a 197% increase in hospitalizations related to adolescent obesity since 1986.

Particular health risks overweight children are likely to suffer as adults as identified by Bramson-Paul, Ellerbe, and Marcello (2006) included chronic diseases such as type 2 diabetes, cardiovascular disease, hypertension, certain cancers, and psychological issues. One study found that 60% of youth who were overweight had at least one risk factor for cardiovascular disease, and 25% of overweight youth had two or more risk factors (Dake, et al., 2008). Research done by Fly and Gallahue (2002) quoted the American Dietetic Association, “If we keep on eating the way we do now, by 2030, everyone in America will be obese” (Fly & Gallahue, 2002, p. 193). It was found that obesity is the second highest cause of adult mortality in the United States. On the other end of the nutrition spectrum, research found that 33% of adolescent females tried to control their weight by methods such as purging, diet pills, and laxatives (Massey-Stokes, 2003).

### *Nutrition and the Body*

Research conducted by Shahid (2003) found proper nutrition to be critical for physical and mental growth, development, and ability. It has been found that healthy diets that abide by the U.S. Food Guide Pyramid positively affects problem-solving skills, test scores, and school attendance. These three areas of learning have all been found to contribute to overall student performance in school (Shahid). Taras (2005) found that chronic hunger, deficiency in iron, a consistent lack of eating breakfast, and overall nutritional problems to be interconnected and significant to academic performance. Research by Massey-Stokes (2002) found that when the body is iron

deficient it is unable to make oxygen-transporting hemoglobin which leads to weariness, a shortened attention span, and damaged cognitive function.

According to Massey-Stokes (2002), problems faced by youth who are malnourished and misnourished included cognitive underdevelopment and poor academic achievement. These problems were also affected by low levels of student energy and concentration as brought on by inadequate nutrition. The consumption of low-nutrient foods was found to directly correlate with an increase in student problems such as school absences and tardiness, hyperactivity, aggression, anxiety, and low scores on tests (Shahid, 2003). According to Massey-Stokes, the body was found to be more apt to infections and illness when it is undernourished, which led to increased absences from school. Research conducted by Asbridge, Florence, and Veugelers (2008), found that students who eat breakfast had higher cognitive functioning than those who skipped it.

#### *Nutrition and Student Subpopulations*

According to Massey-Stokes (2002), results of the 1999 Youth Risk Behavior Surveillance System showed that black students were more at-risk for being overweight than white students. Black students were also more at-risk of drinking less than three glasses of milk daily, when compared to both white and Hispanic students (Massey-Stokes). Students attending alternative high schools, which had seen a 2.5% increase in enrollment between the 1988-1989 school year and 1997-1998 school year, had higher health-risks than students attending regular schools, and health-risks included unhealthy diet and physical inactivity (Fulkerson, et al., 2004). A survey given to educators at alternative high schools throughout Minnesota had them rank nine specific issues that students face, and unhealthy eating and physical inactivity held the last two spots on the

list when results were compiled (Fulkerson, et al., 2004). According to an administrator from one of the suburban schools interviewed, “Do we think if our kids were more physically fit and healthier and keeping better hours and all, that we’d see a change in their behaviors and attitudes and alertness? Yeah, we certainly would” (Fulkerson, et al., 2004, p. 21).

It was found that students of all socioeconomic status’ are at risk of improper nutrition, however, students from families with low-income were found to be more likely to consume convenient, less nutrient-dense foods (Shahid, 2003). Research conducted by Shahid (2003) pointed to middle school-aged children as being the most critical age to educate and establish healthy eating habits, due to the fact that self-concepts, interests, values, skills and behaviors had been found to take shape during this time.

#### *The Role of the School and Society in Student Nutrition*

Shahid (2003) identified a number of duties that the school is responsible for in regards to its students. The prevention of unnecessary injury and chronic health conditions that can lead to early death were highlighted as being a top priority. Research also stated that improving the condition of the individual is a responsibility for those who work in the school. Winter (2009), stated that it was critical to provide all teachers with adequate health, nutrition, and physical activity training in order to assure student success in beating the curse of extreme amounts of excess weight and poor academic performance.

Research by Asbridge, Florence, and Veugelers (2008) found the academic performance of children to impact the amount of education they attain, which in turn increased future socioeconomic status, which was found to influence health care, self-

esteem, and overall quality of life. Since the adequate nutrition was found to be a catalyst in these relationships of academia and socioeconomic status, this research suggested that academic performance is a public health concern (Asbridge, et al., 2008).

### *Nutrition and Emotional Health*

Bell and Luebbe (2009) found that emotional issues, specifically depression and anxiety, could not only affect school performance but were impacted by nutritional intake and this included consumption of caffeine. Students who had access to caffeine by the purchase of coffee, energy drinks, and soda in school reported emotional benefits as well as negative emotional effects. A decrease in lethargy, an increased attention span, and deftness in performance tasks were noted benefits, while increased nervousness, jitteriness, and fidgeting were reported as negative consequences of caffeine use.

Hazzard (2009) found the positive effects of caffeine could also be attained by proper eating, enough rest, and exercise. Research found that caffeine withdrawal symptoms, such as headache, were found to impede cognitive functioning and sleeping patterns, which were both found to affect academic and social situations negatively as well (Bell & Luebbe, 2009). Depression and anxiety were both found to have the potential to hinder academic performance, and the research supported that these emotional disorders were found to be linked to increased consumption of caffeine (Bell & Luebbe, 2009).

Brown, Schiraldi and Wroblewski (2009) found that eating disorders, involving both overeating and under eating to be seriously influenced by emotional stressors. Research conducted by Jalongo (2008) found that stress can significantly impede student performance in school. Mogel (2005) found an increase in eating disorders as well as headaches, school phobias, and obsessive compulsive disorders to be directly linked to

high-levels of stress among high school students. The same study found that students who attended independent schools were more likely to receive a “whole child” education, including emphasis on drug and sexual education, nutrition education, creativity and leadership; as opposed to students who attend public school. It was also found that a mind set in concentration, engagement in meaningful tasks, repetition of tasks, and student-controlled feedbacks were critical to the learning process (Jalongo, 2008). Eating disorders were found to hinder the key features to the learning process and therefore affect student performance in a negative way.

#### *Cultural Barriers to Healthy Eating Habits*

According to Fly and Gallahue (2002), the U.S. Food Guide Pyramid was designed to guide Americans’ food choices based on variety, proportions, and moderation. The U.S. Food Guide Pyramid has been found in classrooms across the country, but many students have difficulty relating to the pyramid because of cultural barriers, such as language and food customs. Availability of food, economics, and family traditions were also found to significantly impact food selection among students and adults alike. (Fly & Gallahue). A large number of people of African American, American Indian, Mexican American, and Asian American descent were found to be lactose intolerant, with the intolerance beginning during childhood. The emphasis on primarily milk-based foods as sources of calcium, as the U.S. Food Guide Pyramid was found to do, was identified as a major barrier that has been found to impede nutrition education in certain cultural groups (Fly & Gallahue).

#### *Combating Cultural Barriers to Healthy Eating Habits*

Research suggests that cultural barriers were successfully combated by showing students Food Guide Pyramids which have photos and drawings of foods they can relate to based on their own culture. Sample Food Guide Pyramids which provide for a cultural variety of Food Guide Pyramids were designed by the Center for Applied Research in Anthropology at Georgia State University to be available for use by educators (Fly & Gallahue, 2002). The culturally diverse pyramids included new food suggestions for new Americans and were found to be successful in educating students about food choices (Fly & Gallahue). Foods have been found to be useful in unification of students, since most cultural groups have been found to include food in celebrations. Discussion about good food choices was found to be effectively stimulated by students by sharing of cultural food traditions. This research also found that the incorporation of non-milk based calcium rich foods such as dark green vegetables, calcium-fortified orange juice, and a variety of breakfast cereals are alternatives that lactose-intolerant students and adults alike could identify with and integrate into a healthy diet.

#### *Other Barriers to Healthy Eating Habits*

According to O’Dea and Yager (2008), educator’s own issues with health have been found to impact student nutrition. The research confirms that health and physical education teachers are expected to lead the quest for the prevention of unhealthy students (O’Dea & Yager). It was found that eating disorders and inadequate nutritional practices were prevalent among young professionals in health professions, including health educators, and there is evidence that these habits had been unintentionally transferred to students (O’Dea & Yager, 2008). According to O’Dea, “Failure to address trainee teachers’ body image problems may also lead to the inadvertent modeling of

unintentional transfer of poor body image, disordered eating and exercise attitudes and behaviors to school students” (O’Dea and Yager, 2008, p.481).

An administrator from an urban alternative high school summed up the issue of adequate nutrition’s ranking in importance of student problems. They noted, “You only have so much attention or so much time during the day, so you can’t worry about all these things at once. So, I think teachers probably tend to focus on the ones that they feel like they’re mainly here for. But behavior [healthy eating and physical activity] is a big one because it relates directly to [students’] ability to receive instruction” (Fulkerson et al., 2004 p.121 ). This study confirmed that issues such as drug-use, truancy, emotional problems, and sexual activity were seen as more important than adequate nutrition for students (Fulkerson, et al., 2004).

Research conducted by Bramson-Paul, Ellerbee, and Marcello (2006) identified fundraising events held by schools as well as the use of food in the classroom by teachers and administrators during classroom parties or as rewards and punishments to be culprits that contributed not only to problems of student overeating but student misconceptions of food and its nutritional purposes. The same study found that student stores and athletic events to be events related to school that could affect student nutrition (Bramson-Paul, et al., 2006). One study found that students had easy access to vending machines and fast food restaurants presence of vending machines and this hindered student nutrition (Fulkerson, et al., 2004).

### *Combating Barriers to Healthy Eating*

Strong leadership and partnerships are critical in combating the issues of poor nutrition and student health. Much research suggested that standards must be established

and abided by students, teachers, administrators, other school staff, and community members. Leaders within districts must support and enforce healthy food and beverage availability to their students (Bramson-Paul, et al., 2006). Parental involvement was found to be potentially stimulated by newsletters home in one study, however another study found that the actual percentage of parents who were reading the newsletters to be uncertain (Blom-Hoffman, et al., 2008). Other suggestions the research made note of to be incorporated into districts were giving healthy snack lists to parents, requiring classroom parties to use non-food treats, having recess before lunch, hosting nutrition events, and starting a nutrition elective which takes place outside of school hours for students to get involved in the community (Bramson-Paul, et al., 2006).

Research has stated that there have been a number of district, state-wide, and national policies that were implemented in attempts at turning student populations into healthier eaters. During the fall of 2006, over 15,000 local school wellness policies were implemented across the United States (Anonymous, 2007). Most of the plans were centered on increasing the availability of healthy foods for students to choose from in their cafeterias. Evaluation of the plans successes and failures, via surveys, took place a year after their implementations. It was found that more than 83% of the districts which responded reported an increase in healthy food options (Anonymous, 2007).

Taras (2005) found that schools which had a breakfast program not only had lower tardiness and absentee rates, but positive short-term effects on brain function as well. Verbal fluency, arithmetic, attention tests, memory, creativity, endurance, and general cognitive functioning were all short-term effects that were found to be a result of eating breakfast. The research also found a connection between schools that had high

percentages of breakfast eaters and higher scholastic scores. The effect of breakfast as studied by Taras (2005) focused on short-term effects, and the long-term effects of eating breakfast on academic achievement are yet to be determined.

### *Nutrition Education*

Although adolescents' general knowledge of healthy eating and healthy eating practices were found to be minimal, overall attitude from students favors learning about healthier eating (Casazza & Ciccazzo, 2006). It was found that observation and experience had as significant of an impact on student eating habits as teaching (Shahid, 2003). Students responded well to computer-based nutritional lessons, and Casazza and Ciccazzo credited this to a number of reasons. They found that computer-based instruction was more able to reach students with different learning styles and that the instruction was more tailored to behaviors, needs, and beliefs of the individual students. Computer-based instruction was found to be more engaging and relevant to students than standard teaching of similar nutrition content (Casazza & Ciccazzo, 2006). Another study sent interactive activity books home with students to be completed, and it found that using the books was effective in increasing students' daily fruit and vegetable intake (Blom-Hoffman, et al., 2008).

Integrating good nutritional practices and skills across all areas of education curriculums, including mathematics, science, social studies, physical education, and English is critical in ensuring nutritional understanding by students (Bramson-Paul, et al. 2006). Research done by Albertsen (2003) found that supplementing nutrition classes with curriculum based on peer-pressure to be critical in ensuring understanding and influencing the nutritional habits of students. Research done by Massey-Stokes (2002)

confirmed that peers have significant impact on student behaviors, and peer role modeling could be an effective tool in educating fellow students.

### *Nutrition and Behavior*

According to Anderson and Kesner (2003), negative behavior, including fighting, was found to be directly related to poor nutrition. Middle school principle Anderson ran a school which was “viewed as the toughest school in the district” (p. 56). Stimulated by the fact that 75 % of the students at his school bought lunch on a daily basis, nutritional changes were implemented to impact how, what, and when students ate. Previously consisting primarily of high-fat, high-sugar foods, Anderson once described a portion of the cafeteria looking “like the candy bar aisle in the grocery store.” (Anderson & Kesner, 2003, p.57). The high-fat, high-sugar foods were replaced with fresher and healthier foods, and Anderson also worked to alter how and when the students ate lunch. Students lunch choices were no longer limited to high-fat, high-sugar, but they could choose from healthier foods served a la carte as well as from a vending machine. Soda was eliminated and replaced with water and juice drinks. Recess was changed to take place before lunch and the lunch period was extended to promote a more enjoyable lunching experience. When these changes were implemented, there was a significant decrease in student fights and a near elimination of suspensions and expulsions (Anderson and Kesner, 2003).

Significant behavior changes in students were reported by 50% of those who participated in a follow-up survey that was administered to schools who implemented healthy wellness policies which involved offering students whole-wheat, low-fat, fruit and vegetable dense options for school lunch and snacks (Anonymous, 2007).

### *Vitamins, Minerals, and Academic Performance*

According to Kaplan and Shannon (2007), amino acids, vitamins, minerals, and fatty acids are the building blocks of brain function. A study conducted by Taras (2005) found that giving students iodine through dietary supplements was partially successful in reversing negative cognitive effects as well decreasing number of school days missed. The same group of students also showed improvement in fine and gross motor skills, attention span, theoretical reasoning, and competence for concepts. Taras (2005) also found that poor academic scores, primarily in math, may be linked to iron deficiency. The same study found that with iron supplementation academics would improve too.

### *Summary*

Adolescents who are either overweight or obese or undernourished have been found to have significant difficulties in school achievement, in both academic and behavioral areas. Much research was done to find specific links between areas of nutrition and their effects on the brain and academic performance. Limitations that existed in the research had to do with long-term effects of eating breakfast, when compared to the number of known short-term effects. According to Kaplan and Shannon (2007), limitations were present on interactions between particular vitamin and mineral supplements and drug interactions on the brain and their nutritional implications. The support of family and community members was highly stressed in much of the research, however many possible limitations existed as to the reality of family and community participation in attaining nutritional goals.

The research suggested that follow-up studies of policies that have been implemented in districts need to occur thoroughly and frequently to ensure their success

at improving the student nutritional health and social, emotional, and physical future health statuses.

### Methodology

Data for this study were collected over 14 class days from subjects in an eighth-grade science class of various ages, educational levels, and backgrounds. Subjects completed questionnaires each day about nutritional choices and the instructor evaluated major areas of academic achievement daily. The areas of academic achievement that were examined were participation, attendance, work, and behavior. A 5 point scale was developed to rank subject nutrition for the day and achievement and provide for correlation between the two areas under investigation.

### *Participants*

Participants in the study were selected from an urban school which harbored grades 7 to 12. The school had 1,194 students enrolled in it and 101 full time teachers. 74% of students were eligible for free/reduced lunch. The student body was made up of 81% African American, 11 % Latino, 7% Caucasian, 0.1% Asian, and 0.4% Native American. An eighth grade science class was selected to participate in this study. The class met every other day from 12:00 p.m. to 1:30 p.m., except on Wednesdays, when the class met from 11:45 a.m. to 1:00 p.m. The class contained 27 students, 9 of whom were male and 18 whom were female. Four of the students from the class did not attend regularly. Of the 9 males, 8 were African American, and one was Caucasian. Of the 18 females, 16 were African American, one was Latino, and one was Caucasian. Twenty four of the students were first time eighth graders, one female was repeating the eighth grade, one female was classified as a ninth grader because she had passed all her eighth

grade classes except for science, and one female in the class was in eleventh grade, because she transferred in from a school in New Jersey halfway through the year and needed to take the New York State Regents Exam for this science class, for credit to graduate on time from her new school. All of the males in the class were first time eighth graders. One male and two females in the class were fourteen years old, one girl was sixteen, and the remaining students were all thirteen. Twenty one of the 27 students were eligible for free/reduced lunch. The subjects in this study sat in assigned seats at desks with two subjects at each.

### *Data Collection*

Subjects were given a questionnaire (see Appendix A) about their personal nutritional choices when they entered science class each day, for 14 class days. The survey had the same six questions on it and was completed at the beginning of class each day for the duration of the study. If a subject was absent from class they did not participate in the study for the day. The instructor made observations throughout the class in areas of behavior, work completed, attendance and participation. After class, when the subjects were gone from the room, the instructor ranked each subject's daily performance in each area on a scale of 1 to 5. The instructor ranked each subject on the back of the questionnaires they filled out (see Appendix B). Participation was abbreviated "P", attendance was abbreviated "A", work was abbreviated "W", and behavior was abbreviated as "B" in the instructor ranking section. Each category was followed by 1,2,3,4 and 5 for the instructor to circle. Subjects who had flawless behavior were given a 5, while subjects who were asked to leave class or were extremely disruptive received a 1. Subjects who had minor, moderate, or many behavior issues

received a 4, 3, or 2, respectively. Subjects who were on time to class received a 5 for attendance, while subjects who arrived within the first five minutes of class were given a 3. If a student was asked to leave class they received a 1 for both attendance and behavior. The instructor ranked participation of each subject with a 5 for active participation and a 1 for no participation. Subjects were given a 2, 3, or 4 for minimal, moderate, and good participation, respectively. The instructor evaluated work produced by the subject on a 1 to 5 scale, with 1 being no work completed and a 5 if all assigned work was completed that day. The teacher considered student's individual abilities and work that was expected to be done when determining if a student would receive a 2, 3, or 4 for their ranking in work for the day. When all the questionnaires were completed for the duration of the data collection, they were grouped for each participant, and each participant was assigned a number. The numbers for the four categories were averaged together and placed on a log sheet according to subject number (see Appendix C). Absent subjects were given an "X" on the log sheet for the day.

The instructor collected data on types and amounts of food that the subjects ate before coming to class that day. The nutritional choices of each subject were ranked on a scale of 1 to 5. The instructor considered the 2005 dietary guidelines when the subjects' nutritional choices were ranked (U.S. Department of Health and Human Services, 2005). A rank of 5 was given when the subject's nutritional choices involved foods from the fruit, vegetable, whole-grain carbohydrate, and dairy/protein food groups. A rank of 3 was given to a subject who included some foods from the aforementioned food groups but also some foods from the fats, oils, and sugars food group. A rank of 1 was given to a subject who only ate foods from the fats, oils, and sugars group before class, or did not

eat anything before class. A subject received a 2 or a 4 if their choices were partially between a 1 and 3 or a 3 and 5 respectively. Amounts of each food consumed as well as predictions for later nutrition in the day were also taken into consideration while the nutritional choices were ranked.

Ranking for nutritional choices for each subject were placed in a log (see Appendix D) according to subject number, for each day. Subjects who were absent for the day were given an “X” on the log sheet.

### *Procedure*

Before the study took place, the instructor created the questionnaire and assigned numbers 1-27 to the subjects in the study. Before subjects entered the room, the questionnaires were placed in a pile to be picked up by the students, in the same spot they usually pick up work to be done at the bell when class starts. Upon walking into the classroom subjects sat at their assigned seats and took out a writing utensil or were given a utensil to write with if they did not have one of their own. After a bell rang to start class, the instructor told the subjects to follow along with the directions at the top of each questionnaire, as the instructor read the directions for completing the questionnaire by writing answers to the questions and providing as much detail as possible. The instructor read the directions twice and alerted subjects they had six minutes to complete the survey. The instructor set the time on the timer for six minutes and started it. The subjects completed their questionnaire and kept them at their seats until the timer went off. Subjects were instructed not to leave their seats until all the surveys were collected. The instructor collected all of the subjects’ surveys, placed them in a folder, and put the

When the subjects were out of the room the questionnaires were removed from

the file cabinet to be analyzed. On the back of each individual survey, the instructor rated the subject's participation for the day on a scale of 1 to 5. The instructor then ranked the subject's attendance on a scale of 1 to 5 and then the subject's behavior. The instructor then assessed any student work and ranked their work for the day on a scale of 1 to 5 (see Appendix B). Next, the instructor found the average for the four categories the student was ranked in and the average was placed on the survey sheet as well as placed on the log sheet for the day (see Appendix C). The instructor then analyzed the foods that the subjects had eaten before class that day and ranked the foods and amount of food eaten on a scale of 1 to 5, placed the number on the sheet and logged it in the nutritional choices log (see Appendix D).

When the questionnaires were completed by the subjects and evaluated by the instructor for fourteen class meetings in a row, the instructor placed the average data for each subject in a table to be analyzed (see Table 1).

### Results

Areas of academic achievement including behavior, work, participation, and attendance produced a mean score of 3.915. The mean score for nutritional choices was 1.640. The range of academic achievement scores was from 2.062 to 5.000, and the range for nutritional choices were found to be 0.444 to 2.667 (see Table 1). The r-value for the data was found to be .5694, which provided an  $r^2$  value of 0.324 (see Appendix E). The  $r^2$  value indicated that a correlation between nutritional choices and academic achievement did exist. When the  $r^2$  value was analyzed as a percentage, it showed that nutritional choices and academic achievement influence each other by 32%.

Three of the 27 subjects consumed one caffeinated beverage before they attended at least one class during the duration of the study. One of the subjects consumed one caffeinated beverage before class 40% of the times they attended. Another subject consumed one caffeinated beverage before class 29% of the time. The last subject who listed caffeinated beverages on their questionnaire consumed a caffeinated beverage before class 9% of the times they attended.

### Discussion

The school that was used in the study had many students who were identified as “at-risk” or had behavior problems, and had a majority of students who were below state averages on standardized testing. Many students in the school are frequently asked to leave class or spend time in alternative education programs such as in school suspension or an after school program due to behavior problems. It is possible with the high occurrence of students with minimal to major behavior problems and poor achievement on standardized testing that the environment that the school could be deemed as “high stress.”

The occurrence of subjects who did not eat anything before class during the day and provided no prediction for what they would eat later in the day could be interpreted in a number of ways. It is possible that those subjects may have an eating disorder, stress or non-stress induced. According to research conducted by Brown, Schiraldi and Wroblewski (2009) links are present between emotional issues and eating disorders, such as anorexia nervosa or bulimia nervosa. Attending school in a “high stress” environment could be the reason the subjects who did not eat and/or have an eating disorder are as so. Some students may have chosen not to eat due to the choices offered to them by the

school cafeteria, at home, or wherever else they had been before school that day. All students who did eat before class each day that the study took place obtained at least some of the food and drink they had from the school cafeteria that day. Future research on student nutrition and academic achievement could look more deeply into choices offered to students for breakfast and lunch at school. This could be extremely beneficial especially to schools which have a high population of students who receive free or reduced lunch programs and are dependent on the school for one or two of their meals. If students are not eating as well as they could due to what is available to them at school, a study would be beneficial to provide reasoning and revisions for food services at any and all levels of education. Research could also be conducted on food and drink from vendors close to school where students may purchase items before and after school hours. Food and drink available at home could also be beneficial to examine and compare to student preferences.

In some instances, the subjects would not turn their survey in because they did not complete it. Based on instructor observations, this was usually due to the inability of some students to get settled into class and start completing their questionnaire right away. The ranking for behavior “B” was influenced by the ability or inability for a subject to get settled and started on the questionnaire. The questionnaire included specific directions which encouraged students to recall every food and drink they had before class for the day, and the instructor emphasized providing details of flavors and amounts. The instructor reminded students verbally to include all details, such as type of bread for sandwiches and condiments, but some subjects were still incomplete in their responses. When nutritional choices were ranked, only the foods listed were evaluated and no

assumptions were taken into consideration. The mode of how the questionnaire was completed could be altered in a future study. If certain technology was available, subjects could answer similar questions as were on the study but on a computer program or website which would not allow subjects to move on to the next question until all fields were complete. For example, students would have to put the amount of each food and drink they consumed. Instead of an answer “donut” they would have to put whole, half, or quarter of a donut. Investigations conducted by Casazza and Ciccazzo (2006) found students responded well to computer-based nutritional lessons, based on the ability to reach a wider variety of learning styles and an overall more individual approach. This same approach could be utilized in administering a set of questions to subjects involved in an extension of this study. Visual examples as well as auditory cues could be present if the questionnaire were tailored to a computer-based approach. This process would require more planning but could increase the accuracy of results.

The literature stated that students of all socioeconomic statuses were at risk for improper nutrition; however, students from lower income households were more likely to consume convenient foods with low nutrient density. All of the subjects who participated in this study were from low income households, and the average nutritional choice ranking was found to be 1.640. When considered as a high or low number on a scale of 1-5, 1.640 is considered to be low. An extensive look could be taken at parents, guardians, and siblings of the subjects who participated in this study to examine the influence of the home environment and nutritional priorities and if and how they carry over to students when they are at school. Relationships could also be examined between

overweight or underweight family members and students by studying home life and nutritional links to school.

Using a 1-5 scale to rank students in areas of behavior, work completed, participation, and attendance could possibly lead to a difference in results if the study were to be conducted at a school with higher state test scores, and less students with behavior problems. Students who were given a 5 for all areas of academic achievement for a day may have been given a different number if they attended a school with different demographics and environmental surroundings on a daily basis.

The subject who consumed caffeine 40% of the time before attending class had an average academic achievement score of 3.800. The subject who consumed caffeine 29% of the time had an average academic achievement score of 4.343 and the subject who consumed caffeine 9% of the time had an average academic achievement score of 4.205. Based on this, this study provides mixed results of whether caffeine affects academic achievement in a positive or negative way. The research conducted by Bell and Luebbe (2009) stated both positive and negative effects of caffeine use among students therefore the findings in this study supports their findings. The findings in this study also suggest that future research more focused on caffeine use among students could be useful and beneficial to the learning process.

Future research could be conducted more thoroughly if it were done at more schools with students in different grades, different classes, and of different demographics over an extended period of time. According to O'Dea and Yager (2008), educator's who have their own struggles with health, whether overweight or underweight are unintentionally transferred to students. If the study were to take place in a variety of

different classrooms, interviews with instructors about their own nutritional status could be evaluated and compared to the results provided by the students to determine if the research done by O'Dea and Yager (2008) is supported. An added benefit to extending the study to more classrooms and schools are the results between schools of different demographics could be compared to see if more correlations exist.

### Conclusion

All who are involved in the field of education should be aware of the significance nutritional choices play in how students function to obtain and retain true understanding of content which will open doors to their individual futures as well as impact future society as a whole. This study shows that better nutrition leads to better behavior and this make the entire schooling experience better for teachers, administrators, parents, and students alike. When students consume balanced, portion appropriate, meals which abide by the national guidelines and standards set forth for nutrition, their bodies and minds respond and function optimally. Besides the impact that nutrition has on young people academically, there is a major health crisis in America today that includes a serious increase in overweight and obese children and adolescents as well as hospitalization rates due to complications of excess weight. A struggle also exists among students who are under weight due to self-inflicted disordered eating or malnutrition based on home life or other environmental factors. The general health of the youth of the country indicates what the future will hold for health care and society as a whole, since habits developed at a young age often stick with people for life.

If the point of view is considered that roles of a teacher includes improving student's conditions and equipping them with skills to make good decisions throughout

life, incorporating nutritional skills into all curriculums is critical. Future research on relationships between areas of academic achievement and nutrition, as well as increasing nutritional knowledge among all who are involved in the academic community is critical.

Universally, young people are interested in learning about things that they can relate to, things that “matter” to them. Nutrition is a unifying thing—everybody needs it to live and has to obtain it from drinking and eating. Food is used in almost all cultures as celebration and tradition. It is up to teachers and researchers to capitalize on this common ground and to discover the best ways to educate the students of today on the importance of proper nutrition and health, and how it relates individuals and their present and future wellness, so they can lead long, happy, and healthy lives.

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Appendix A  
 Sample Questionnaire given to Subjects

You have 6 minutes from after the bell rings to answer the questions below. Please give as much information as you can!

Question	Answer
Did you eat or drink anything before you got to school today? (Yes or No)	
What did you eat or drink before you got to school today, and how much of it did you eat or drink? What kinds or flavors did you have?  <i>Example: Half of a chocolate donut or 1 apple</i>	
Did you eat at school today? (Yes or No)	
What did you eat at school today, and how much of it did you eat or drink? What kinds or flavors did you have?  <i>Example: 1 whole can of lemon-lime soda</i>	
Did you get the food you ate at school today from the cafeteria? (Yes or No)	
What foods and drinks do you plan on having later today?	

Appendix B  
Sample Instructor Rating for Subject Performance, Back of Questionnaire

Subject # \_\_\_\_\_

P: 1 2 3 4 5

A: 1 2 3 4 5

W: 1 2 3 4 5

B: 1 2 3 4 5

Average: \_\_\_\_\_





Appendix E  
Academic Achievement vs. Nutritional Choices

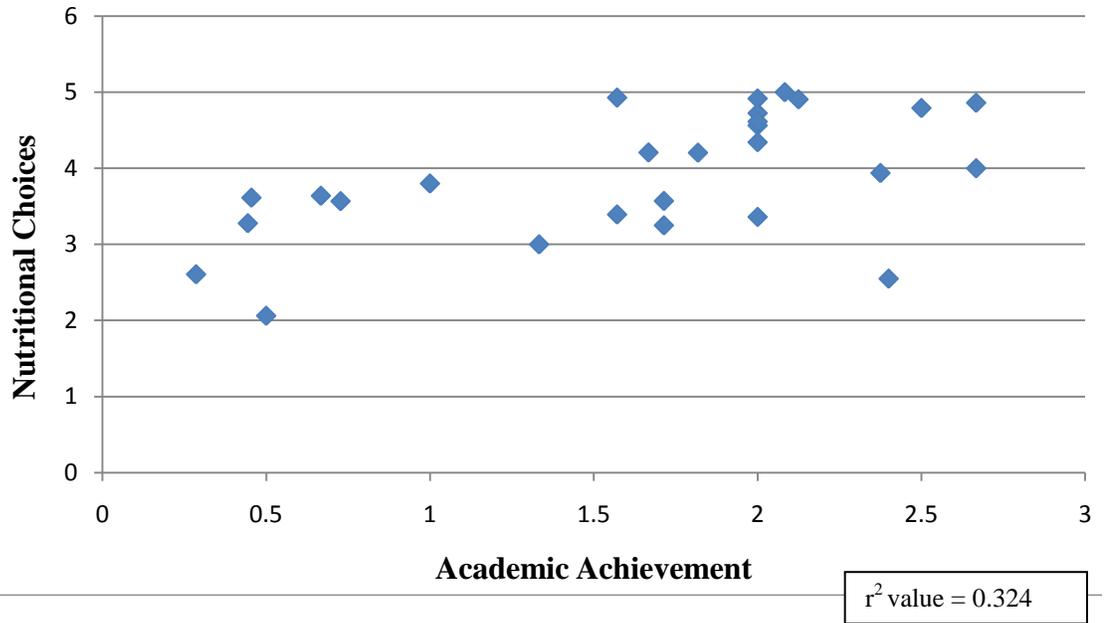


Table 1  
*Average Academic and Behavior Scores, Nutritional Choices, Subjects #1-27*

Subject #	Academic & Behavior Scores	Nutritional choices
1	3.278	0.444
2	3.250	1.714
3	4.563	2.000
4	4.929	1.571
5	4.205	1.818
6	4.861	2.667
7	4.208	1.667
8	3.000	1.333
9	3.800	1.000
10	3.393	1.571
11	2.550	2.400
12	3.639	0.667
13	2.607	0.286
14	4.917	2.000
15	2.062	0.500
16	4.725	2.000
17	3.568	0.727
18	3.614	0.455
19	3.571	1.714
20	3.361	2.000

*(continued)*

*Table 1 (continued)*

Subject #	Academic & Behavior Scores	Nutritional choices
21	4.792	2.500
22	4.614	2.000
23	5.000	2.083
24	4.906	2.125
25	4.000	2.667
26	3.938	2.375
27	4.343	2.000
Average	3.915	1.640