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Impact of Nutrition Education on Student Learning

Lydia Singura
Walden University

Walden University

COLLEGE OF EDUCATION

This is to certify that the doctoral study by

Lydia Singura

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Review Committee
Dr. David Stein, Committee Chairperson, Education Faculty
Dr. Nancy Walters, Committee Member, Education Faculty
Dr. Robert Hogan, University Reviewer, Education Faculty

Chief Academic Officer

Eric Riedel, Ph.D.

Walden University
2013

Abstract

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MA, Kean University, 1995

BS, James Madison University, 1968

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

A goal of schools is to provide students with practical nutritional information that will foster healthy lifelong behaviors. Unfortunately, students at one school were found to have difficulty grasping basic nutritional information and practical health-related skills. There remains an important gap in current literature regarding strategies to improve students' understanding of nutrition education material. The purpose of this study was to investigate the benefits of a 4-week nutrition intervention unit in the Foods I classes consisting of 82 male and female students in Grades 9-12. Constructivist teaching methods were implemented to provide students with both information and valuable skills, which might positively impact student health and student learning. A pre-experimental quantitative design was used for this study. The repeated-measures *t* test was used to compute differences in pre- and post-tests scores on the nutrition test, which indicated a 6.207 mean increase in student posttest scores. The 82 students also completed a Likert style survey, which indicated both a positive student result in perceiving a better understanding of nutrition knowledge, and a positive change in dietary choices due to constructivist teaching strategies used in the intervention. These results revealed the benefits of the nutrition intervention unit by the significant increase in students' nutrition knowledge and students' implementation of that knowledge in daily living. The results make an important contribution to the existing literature and can enhance social change initiatives through increasing students' knowledge of nutrition, providing them with life-based skills, and enhancing their quality of life.

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ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 - 1346

Dedication

I am grateful to my parents who understood the importance of an education, especially to my father who insisted I attend college even at a time when the belief was that women did not require a higher education. A special thank you to my brother Roman Hluszczyk who was a financial benefactor at a difficult time in our lives with the untimely passing of our mother. Many thanks to my husband Zenon and daughters Sophia Ricciardelli and Tanya Soltys who supported me through this endeavor with their love, understanding, encouragement, and technological expertise.

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Section 1: Introduction to the Study

In October of 2002 a Healthy Schools Summit: Taking Action For Children's Nutrition & Fitness took place in Washington, D.C. This summit was a result of a 2001 U.S. Department of Health and Human Services' document titled "The Surgeon General's Call To Action To Prevent and Decrease Overweight and Obesity. A Commitment to Change" document adapted from the Surgeon General's Call to Action outlined actions to create a healthy school environment which was identified as critical and outlined specific actions for summit collaborators (p.3). The summit collaborators "recognize the critical need to improve children's overall health and to manage obesity and overweight" (p.3) and understand that children are most educable in a healthy school environment where "dietary behavior and patterns can be shaped and physical activity can be encouraged and positive habits can be formed" (p.3). The collaborators also stated the following:

Schools provide a total learning environment for developing and practicing lifelong behaviors. Poor dietary habits diminish nutrient quality and thereby contribute to suboptimal health status and performance. The amount of time children are engaged in physical activity continues to decrease. There is a national imperative to improve academic performance and close gaps among ethnic and socioeconomic groups (p.3,4).

Satcher (2001) Surgeon General, identified schools as a key setting to help address the national health challenge. He stated

> Obesity is not a cosmetic issue; it is a health issue and our best hope for combating the epidemic is to prevent children from becoming overweight in the

> first place. Schools have the opportunity-even the responsibility-to teach and model healthful eating and physical activity both in theory and in practice. (p.2)

It is critical that nutrition be taught in schools at an early age. Schools are a significant environment in children's lives because of the control they have during the school hours and the access to food, and the strong impact of decisions and behavior of the school leaders. Schools help students develop lifelong habits and preferences and feeding programs are already in place. Schools are a key link to the parents and the community (p.2).

The Action for Healthy Kids organization's The Learning Connection report (2004) stated that providing a high-quality education for students is the ultimate goal of schools and the key to boosting academic achievement is good nutrition and physical activity. With this goal in mind schools may also maintain or even improve their financial issues because when students

> Make insufficient academic progress, interventions that support students' emotional and physical health — such as quality physical education programs, more nutritious food and beverage options, and classroom nutrition and health education — can be included as part of the school's improvement plan. (p.27)

The report continues that healthier students lead to better learning which preserves both human and financial school resources (p.27).

Problem Statement

Students in the Foods I classes at the high school were having difficulty with nutrition information. Negative student comments on the end of the year Foods I class evaluations indicated a problem as well. The teachers discussed the outcomes of the evaluation and the Supervisor of the Family and Consumer Sciences Department directed the teachers to initiate an action plan. The purpose of the study was to investigate the benefits of a 4-week nutrition intervention unit in the Foods I classes using constructivist teaching methods to provide students with both information and add valuable skills.

The school district in New Jersey where the study occured is an urban, working class community experiencing many problems, one of which is the turnover in the population. In the last 10 years, the older population has retired, moved, and sold their homes to younger people with young children and/or school-aged children. This has put a strain on the district's schools. Five years ago, several schools were renovated and additions built, but, this has not averted the critical situation of overcrowding in all schools in the district. Programs were cut to accommodate ever growing classroom size and the classes that were cut were perceived of less importance to students. The elimination of these programs was also due to the implementation of the district's technology program, lack of classroom space, and cuts to the school budget.

The high school Family and Consumer Sciences classes were also affected. Parenting, Independent Living, and Foods and Nutrition are still in tact, and these are filled to capacity since the state mandated nine credits of Fine, Performing and Practical Arts to its state graduation requirements.

Background of the Problem

Lichtenstein and Ludwig (2010) stated, "Excessive weight among youth affects virtually every organ system and, according to a recent study, increases the risk of premature death. In addition, obesity adversely affects self-esteem, academic accomplishment, and future earning potential of children" (p.1857). Obesity is described by the American Obesity Association as a disease that affects as much as one-third of the adult population in America (p.1). This number continues to increase. The American Obesity Association also asserted that 64.5% of adult Americans are overweight or obese and that obesity as a disease has a strong familial component (p.1).

According to the United States Department of Agriculture, students are not passing healthy eating because:

- Only 2% of youth meet Food Guide Pyramid recommendations for all five major food groups (recently changed to "My Plate").
- Only 16% of children do NOT exceed the guideline for saturated fat on any given day.
- Teens drink twice as much soda as milk, and fewer than 20% of girls ages 9-19 meet the recommended daily intake of calcium.
- Only 1 in 5 youth consume 5 servings of fruits and vegetables each day.

The United States Department of Agriculture also gave students low marks in nutrition knowledge. According to a student leader poll, 94% stated eating healthy was important

and 74% reported they do so, yet less than 35% knew how many servings were recommended from each of the 5 food groups (www.ActionforHealthyKids.org, 2002).

The National Health and Nutrition Examination Survey (NHANES) for 1976-80 and 2003-06 (http;//www.cdc.gov/nchs/products/pubs/pubd/hsestats/overwght99..html,2005) showed a twofold and threefold increase in children's weight in the 2003-2006 data. Wolfe et al. (2000) stated that a healthy lifestyle can be obtained, along with academic achievement, if good nutrition is combined with exercise. The result is optimal learning. Wolfe added that there is an undeniable confirmation of studies supporting the fact that proper nutrition is critical to maximum performance of brain functions and enhancing learning and high achievement are gained by supporting the health of the whole child (p.54). Wolfe named healthy habits as nutrition, social, environment, and lifestyle important components formed early in life to ensure normal growth and development. This physiological and neurological development promotes optimal learning defined as "the abilities to recall information, to problem solve, and to think critically" (Wolfe, 2000, p. 54).

The Action for Healthy Kids association's report (2004) stated there is a link between nutrition and learning. Studies done at the University of Minnesota, Harvard Medical School, and Massachusetts General Hospital indicated improvement in math grades, reduced hyperactivity, decreased absenteeism, and tardiness among students who ate breakfast on a regular basis (p.1). Campbell and Campbell (2006) stated that few people actually know what to do to improve their health, not because there is not enough

research, but because of the amount of information and misinformation which they call junk science. Fad diets and food industries add to the confusion. The broader perspective on health includes an understanding and use of good nutrition (p.7).

Purpose of the Study

I attempted to demonstrate the benefits of a high school nutrition intervention unit, and to add to the current research on the connection between student learning and proper nutrition. The incorporation of the nutrition intervention unit in the Foods I classes provided students with valuable information and skills that can be useful immediately and in the long-term. By providing these life-based skill development opportunities, students may be able to make nutritionally sound dietary choices. The intervention component of the Foods class focused on presenting information that would increase students' nutrition knowledge.

Pretest and posttest scores following the nutrition intervention unit were analyzed using SPSS data analysis program. A student survey determined whether the nutrition information learned in the 4-week nutrition intervention unit was implemented to make healthy food choices. The potential significance of this study could be a Best Practice model for the State of New Jersey which districts throughout the state could utilize for research, data, and possible implementation.

Research Questions and Hypotheses

Research Question 1: Will students demonstrate an increase in nutrition knowledge following a 4-week nutrition concentration designed using constructivist

teaching strategies component in the Foods classes as measured by pretest and posttest scores?

$H1_0$: There is no significant difference in student nutrition knowledge following a 4-week nutrition concentration component in the Foods classes as measured by pretest and posttest.

$H1_A$: There is a significant difference in student nutrition knowledge due to a 4-week nutrition concentration component in the Foods classes as measured by pretest and posttest.

Research Question 2: Will students perceive a better knowledge of nutrition due to constructivist teaching strategies used in the 4-week intervention?

$H2_0$: There is no perceived change in knowledge of nutrition due to constructivist teaching strategies used in the 4-week intervention.

$H2_A$: There is a perceived change in knowledge of nutrition due to constructivist teaching strategies used in the 4-week intervention.

Research Question 3: Will students perceive a positive change in their food choices due specifically to a 4-week nutrition concentration component in the Foods classes?

$H3_0$: There is no perceived change in students' food choices due specifically to a 4-week nutrition concentration component in the Foods classes.

$H3_A$: There is a perceived change in students' food choices due specifically to a 4-week nutrition concentration component in the Foods classes.

Significance of the Study

I attempted to demonstrate the benefits of a high school nutrition intervention component designed specifically to better prepare students for learning at all levels. The implementation of such a component at the high school should provide students with valuable skills that can be useful in transitioning to the challenges of the real world. By providing these life skills, students may enhance their quality of life. The potential significance of this study is a Best Practice model for the State of New Jersey which districts throughout the state could utilize for research, data, and possible implementation.

Theoretical Perspective

The constructivist classroom was the setting for the study. Constructivist theory has reemerged as educators struggle with reforming the educational system (Vermette et al., 2001). Vermette et al. stated that contemporary constructivism is linked to the philosophies of Dewey, Piaget, Vygotsky, Gardner, and Bruner. Kirka (1997) stated that constructivism is a learning theory that asserts there is an innate human drive to make sense of the world. Instead of absorbing or passively receiving objective knowledge that is out there, learners actively construct knowledge by integrating new information and experiences into what they have previously come to understand, revising and reinterpreting old knowledge in order to reconcile it with the new (p.2).

In order for knowledge to be useful to the learner, it needs to be understood. Although constructivism is not a new concept, some educators find it difficult to adopt into their teaching environments and find it difficult to experiment with various constructivist strategies. Chen et al. (2001) explained that a constructivist believes

knowledge is actively constructed by learners and not passively acquired from instructors. Students can learn more effectively when they own the process and work collaboratively. Tasks then seem real and authentic (p.25). According to Chen et al., there are two major branches in constructivism, the philosophical and epistemological.

Null (2004) asserted that although there are multiple definitions and examples of constructivisim, the concept is indefinable. Null discussed three levels of constructivism, the epistemological, constructive, and prescriptive. Epistemology is the focus on the nature of knowledge and how it is created. The contructive level is focused on how knowledge is established (or constructed) in the classroom by students and teachers. The prescriptive level reduces multiple definitions into useful techniques or tips that can be used by a teacher in the classroom.

Null (2004) explained that educational history has explored educational issues such as connecting prior knowledge to lessons taught using lecture-only instruction, and encouraging the pursuit of student interest for at least 250 years, but that not many educators are familiar with the traditions that shape the current call for constructivism (p.186). Chen et al. (2001) stated that although not new, constructivism is only several decades old in United States literature on learning theory.

Chicoine (2004) stated that knowledge is constructed in opposition to traditional educational views which state that knowledge is fixed. Chen et al. (2001) explained that traditional learning theorists see learners as those who passively receive knowledge that is transported to them during classroom activities. The instructor's role is to supply the content. Chen et al. explained that constructivists look at learning from the perspective

that teachers are facilitators rather than transporters and that they help students to develop their own, individual thinking skills by asking questions that probe an individual's metacognition. Chen et al. noted that the questions asked need to lead learners to knowledge rather than to knowledge disseminated by the facilitators.

Smith (2000) contended that "meaningful learning develops from active construction of knowledge" (p.25). Smith listed eight types of groupings from simple short-term informal groups to complex groupings that involve total reorganization of classes, and each group type can be expanded when the educator desires more student involvement or when success is met. Smith defined the eight types of small group strategies as follows:

1. Informal strategies with extensions: These are groupings where faculty has expanded on the informal cooperative learning strategy of turning to a neighbor. In this concept, students work by twos on an assigned problem. Expanding this group to three or four, the students are assigned a specific job, write individually, then work together to find a rationale. Each group's rationale is compared and contrasted with the whole class to create understanding or consensus.

   Another variation in this category is called the bookends procedure where questions or a task is used to engage the students and help the instructor identify students' previous knowledge. Students work individually, then in groups and end the activity with specific guided reflection questions.

2. In-class project work: The exercises in this type of group work are long-term. Exercises are also more hands-on and more complex in comparison to the informal group.
3. Jigsaw strategies: These involve students in a group where each student has the responsibility of learning a particular part of the material and then reteaching to the group. The educator's role is to jigsaw the material, monitor, and help the groups.
4. Structured academic controversy: The students prepare, present and defend an assigned viewpoint. Students learn to prepare better arguments when confronted by others.
5. Base groups: Cooperative base groups are long-term, stable, and formed by the educator. The groups are monitored and coached and are used to reflect deeper understanding of the material.
6. Problem-based learning: This strategy is built around problem-solving skills and self-directed learning in student-centered small groups. The teacher's role is facilitator.
7. Restructured lecture-recitation-laboratory: This is a group strategy used in large classes. Although the lecture technique is used, major restructuring is made in the discussion sessions. In this environment, teachers and students are actively involved in problem-solving and communicating with each other.

8. Eliminated lecture, substitution of hands-on laboratory: These are laboratory groups where classes are facilitated by highly qualified educators who oversee carefully and thoroughly designed tasks beginning with short and easy tasks and ending with longer complex tasks.

Each of the groupings is assessed to ensure student learning. Smith (2000) concluded faculty are practicing elements of constructivist pedagogy, trying multiple things at once, inside and outside the classroom. Faculty are exploring different ways of conceiving courses to engage students, facilitate problem solving, build critical-thinking and reasoning skills, and create community (p.44).

Sharan and Sharan (1987) described cooperative learning as encompassing different strategies for promoting academic learning through peer cooperation and communication (p.21). In a cooperative learning community, the student's role is to help each other. They share ideas and resources and together plan how and what to study while the teacher allows the students a degree of choice regarding substance and goals of their learning activities. Sharan and Sharan described the model for academic learning as one based on Kolb's (1975,1986) experiential learning theory which is a holistic integration of experience, perception, cognition, and behavior, and the model is rooted in Dewey's philosophy of education and Lewin's integration of scientific inquiry and social problem solving (p. 21).

The New Jersey State Core Content Standards stated that every course offered should enhance student learning through critical thinking, which should include the ability to "categorize, hypothesize, generalize, synthesize, apply, analyze and elaborate

issues of content" (Vermette et al., p. 90). The 4-week nutrition program was taught in a constructivist classroom where learning is a result of the connection a student makes between new information and previous knowledge. Students worked in cooperative problem-solving and collaborative projects which could provide shared opportunities where students could elaborate and build on their knowledge through social interaction. Various teaching strategies attempted to engage and motivate students by raising curiosity and connecting the information and skills to real life and world situations.

Delimitations

The New Jersey town where the study occured is an urban, working class, low-income community. Over 30% of the high school students are from single parent households. The high school population consists of 1,400 students. This may not be a typical community. The nutrition component of a typical Foods class may be more or less than a four week period. The study will be confined to the Foods I classes.

Assumptions

It is assumed that nutrition is an integral part of student learning and that nutrition education is an integral part of students' knowledge in making appropriate food choices. It is assumed that students' food choices are directly related to their ability to learn. It is assumed that peer education interventions, in regard to nutrition education for grade school children, can be incorporated in an effort to educate students and that preparing students for learning should be a cooperative effort between schools, educators, parents and community.

Definition of Terms

Core Curriculum Content Standards: The state of New Jersey established these standards for all public school districts. The standards were developed to ensure all students grades PreK-12 achieve certain levels of learning at each grade level in all academic areas which include mathematics, science, world languages, language arts, social studies, family and consumer sciences, health and physical education, and technology (www.nj.gov/education/aps/cccs/2009/career/standard94.htm)..

Family and Consumer Sciences: The updated name for Home Economics. The name was changed by the national organization, Association of Family and Consumer Sciences (www.aafcs.org.).

Foods I: One of the elective offerings in the Family and Consumer Sciences Department. The Foods I course provides basic information and skills for those students who have little or no knowledge or skills in food preparation (www.aafcs.org).

Nutrition intervention: The 4-week unit that was taught using the constructivist theory (Agnes,2010)..

Constructivism: A learning theory in which learners actively construct knowledge by integrating new information and experiences into what they have previously come to understand, revising and reinterpreting old knowledge in order to reconcile it with the new (Kirka, 1997, p.2).

Nutrition: The process by which the body uses nutrients in food for growth and maintenance (Duyff, 2010).

Nutrient: A chemical that performs a specific job in the body (Duyff, 2010).

Summary

The State of New Jersey recognized the importance of teaching nutrition by incorporating the area of Family and Consumer Sciences in the Core Curriculum Content Standards in all public schools. It is through education that children become productive citizens in their communities and in society. It is the obligation of every district to provide a learning environment that is conducive for each student and that the district's children are coming to school ready to learn. The purpose of this study was to demonstrate the benefits of a high school nutrition intervention unit, and to add to the current research on the connection between student learning and proper nutrition.

Section 2 is a review of the the literature related to nutrition and the implication of sound nutrition to a child's readiness for learning. Section 3 is an explanation of the research design and methodology of the study. Section 4 is a presentation of the original data. Section 5 is the summary and included conclusions and the recommendations of the study.

Section 2: Literature Review

Introduction

Proper nutrition supports and maximizes proper brain functioning and enhances learning. Optimal achievement is attained through normal physiological and nuerological growth and development. Recalling information, problem solving, and critical thinking are the abilities liked to achieving optimal learning (Wolfe et al., 2000, p.54). In order to access the literature to be reviewed, I searched in the ProQuest, EBSCO, and ERIC databases. I used the following key terms: *nutrition*,*learning*,*cognition*,*brain development*,*micro-nutrients*,*healthy diet*,*constructivist theory*,*breakfast*,and *academic performance*.

Background on Early Childhood Nutrition

To understand children's eating behaviors, it is necessary to investigate early childhood nutrition. Johnson (2002) stated that most scholarly work is focused on changing nutrient requirements for children's growth and health without looking at their dietary intake. The infant begins life as a consumer of human milk. The child is born with reflexes to support milk consumption-rooting, suckling, and extrusor (Johnson, 2002). Each of these reflexes cooperate in order to provide the physiologic mechanisms that are necessary for milk consumption.

At about 4 to 6 months, infants begin to transition to solid foods and this timing is influenced by the disappearance of the extrusor reflex and depletion of stores of fetal minerals (Johnson, 2002). Johnson suggested iron-fortified cereal should be introduced followed by vegetables and fruits while meat and animal products should be introduced

last due to a possibility of reactions to them. Consideration for the introduction of micronutrients as weaning foods to infants over 6 months with no food sensitivities is being researched, but is controversial.

Control begins to shift to the infant when the whole-hand grasp and the forefinger-thumb grasp develop which enable the child to begin self-feeding. This occurs around the 9th month. At this point it is important to promote a variety of food choices and recognize the signs of hunger and satiety (Johnson, 2002). The establishement of a secure and pleasant eating environment is important.

Food neophobia, defined as the fear of new food, is an unrecognized developmental milestone in children's eating behavior (Johnson, 2002). Children aged between 18 months to 2 years who previously were good eaters reject new foods and parents react with concern for the child's health; they engage in a struggle over neophobia which exacerbates the problem (Johnson, 2002). Parents need to view and endure this period by understanding that this is normal.

Johnson (2002) suggested exposure to new foods be paced slowly and patience in the face of rejection will lead to adoption of new food. Using this method will ensure dietary variety and establish healthy eating habits that will last a lifetime. Other than exposure and learning from modeling, children can be influenced to prefer certain foods by food cues from high density foods. The carbohydrate and fat containing foods are also high energy as demonstrated in research done in children and rodents (Johnson, 2002).

Johnson (2002) stated, "Social settings and cues from the feeding environment also serve as opportunities for young children to learn about food and eating" (p.92). This

environment can have a dramatic impact on children's reactions and preferences to certain foods and ,in addition, positive attention to these foods can cause preference for them. On the other hand, when children are bribed by food, the gain is usually short-lived for the long term and counter-productive in accepting a variety of foods and establishing healthy eating habits (p.92).

Another important relationship to eating is energy needs. A child's energy intake is internally regulated (Johnson, 2002). Children consume energy according to individual needs (Johnson, 2002). Infants also self-regulate energy. This self-regulating of energy is maintained through at least the prepubertal years and is evident in at lease some adults (Johnson, 2002, p. 93).

Although various factors impact children's weight, parenting strategies heavily impact children's food preferences and food intake. Johnson (2002) pointed to maladaptive outcomes when feeding practices are power-assertive and focused on external adult control, and environments that have minimal social contact with an encouragement from their care providers (p. 93). Carson and Reiboldt (2010) discussed changes in the focus of nutrition education prior to the 1970s which centered on young women being taught how to purchase food and prepare meals and after the 1970s when emphasis was on choosing foods for nutritional adequacy to prevent nutritional deficiencies leading to chronic diseases. Today's focus is food choices and behaviors for health and well-being. Carson and Reiboldt stated that although focus has changed, the fact that people with higher incomes and higher education eat healthier has not changed since the 1970s and that 40 years ago, mothers with the most education lived in higher

income households, had greater grocery allowances, and chose more nutritious and healthier foods to feed their families.

Food advertising is one factor that influences and shapes preference among children. As much as $870 million was spent in 2006 marketing directly to children and currently of the $7.3 billion, $2.5 billion is spent on ads for breakfast cereals, gum, candy, soft drinks, and snacks (Carson & Reiboldt, 2010). The amount of time a child aged 6-8 spent shopping with a parent dramatically increased and parents gave in to a child's food purchasing request 45% to 65% (p.44).

Carson and Reiboldt (2010) believed food preferences of children can be modified through exposure and accessibility to foods, as well as, the modeling behaviors of their parents, siblings, peers, and feeding practices. They explained that after school nutrition interventions foster these changes because of the environment and exposure to new foods with their peers. Subsequently, these new and unfamiliar foods will be requested for purchase by parents.

Nutrition, Brain Function, and Student Learning

Nutrition is one of the many factors that affect brain development in children, but one which can be modified to improve cognitive development (Bryan et al., 2004). According to Bryan et al., there are critical periods of rapid brain growth and development. These periods are from gestation until the first 2 years of life. During this time, brain development may be sensitive to insult, and deficiencies in the diet might have a particular impact (p.295). Some parts of the brain are not developed until growth spurts occur at birth to 2 years, 7 to 9 years of age, and mid teens. Bryan et al. stated that

during childhood, the frontal lobes and developmental functions may be affected by poor nutrition and nutritional interventions. The key nutrients identified for cognitive development are iodine, iron, and folate with zinc, vitamin B12 and omega-3 polyunsaturated fatty acids (Bryan et al., 2004).

Hawke (1998) connected nutrition and its impact on learning, behavior, and development. Hawke cited the increase of learning disabled children and the contributing factors to this problem include chemicals in the air and food. Hawke argued that there can be an immediate and dramatic improvement in a child's functioning and behavior if nutritional status can be addressed. Hawke asserted that because the brain is the controlling center of the body, to function properly, efficiently, and effectively it needs certain nutrients, such as protein, carbohydrates, vitamins and minerals, and if that diet is inadequate the body will not absorb and utilize food properly which may hinder brain development. Since the brain has the richest blood supply of all body organs, there is a higher rate of exposure to toxins. Hawke pointed to the dietary assessment of learning disabled children which indicates many "are allergic, sensitive or intolerant to commonly eaten foods" (p.12). According to Hawke, these children are characterized by one or more of the following traits: a finicky eater, poor appetite, high dairy food intake, a diet very high in grains in the form of breads and cereals, high salicylate intake (commonly in the form of fruit juices), regular intake of foods containing artificial colors, flavors, preservatives (these foods are usually snacks high in fat), and refined carbohydrates (sugars and low nutritive value).

Deas (1996) discussed the effect of chemicals and sugars on the brain in children. Deas referred to the sugary drinks as brain draining threats and sugars and artificial ingredients can cause hyperactivity and learning disabilities in children. These disabilities include poor reading and comprehension skills. Feingold (1986) reported that when the New York City Board of Education eliminated sugar and artificial colors and flavors from the children's diets, test scores increased from 39 to 51% and when the preservatives BHT and BHA were eliminated the number increased to 55%. Overall, scores increased 15.7% over a 4 year period in 803 public schools (Deas, 1996).

Deas (1996) urged parents to pay more attention to their children's diet as the answer to increased classroom performance and to look for certain characteristics of children experiencing brain drain, hyperactivity, poor sleep habits, short attention spans, poor concentrate, antisocial traits, clumsy movements, difficulty writing, poor reading and comprehension skills. Deas pointed to poor nutrition as a cause for children's mental and behavioral problems, not dilapidated schools. Azzam (2010) asserted that children who are exposed often to fats, sugars, and salts heavily rely on them in their diets (p. 9). Barton and Coley (2010) stated that sound nutrition is necessary for a proper development of both body and mind and that hunger suppresses student learning This is evidenced as early as kindergarten where studies pointed to lower test scores among underweight children from the inner city (p.20). Barton and Coley showed a correlation between children of low birth weight and the likelihood of special education classes for them (p. 21). Satcher (2010) argued that schools and educators have a unique opportunity to position students for success regardless of their socioeconomic or ethnicity by playing

an important role in their health. He continued that if all children are to succeed in both school and life, schools must not only promote academic achievement, but also help children develop healthy eating habits and promote physical activity (p. 38).

Wolfe et al. (2000) stated that in order to maximize brain functioning and enhancement of learning, it is critical to provide nutritional support as research is confirming that optimal achivement needs to be supported through the health of the whole child (p.54). Wolfe et al. named a variety of healthy habits including nutrition as an important component which formed early in life ensures normal growth and development. This physiological and neurological development promotes optimal learning, including the ability to recall information, to problem solve, and to think critically (Wolfe et al., 2000, p54).

Kluger (2011) revealed some insights into the brain and how it functions. Maroiss (2011) stated that information processing in the brain is still being investigated, but that the human brain is "the most complex biological structure ever put together, a marvelous organ that the most sophisticated computers do not even remotely equal , save for very specific computational domains such as chess" (p. 33). Brain information and research has changed thinking about learning.

According to the The New Science of Learning; Brain Fitness for Kids (2009), the brain is constantly working and learning but more importantly the brain is neuroplastic meaning it is ever changing. It was once thought that there was a short period of opportunity for a child to learn and if that opportunity was missed the child would be

locked into what he/she had learned. This has been shown to be incorrect and research indicates that the brain can be retrained.

Children come into the educational arena with different speeds such as language abilities from the basic to sophisticated, and positive or negative language experiences. Children need to hear correctly to learn, be motivated to learn, and have a tolerable stress level. The New Science of Learning; Brain Fitness for Kids (2009) pointed to four building blocks of learning and these are memory, attention, processing rate, and sequencing. Each area is important to the others and is needed for meaningful learning. Children are active learners and learn if it is meaningful. Circumstances need to be created for learning and for children to remain engaged.

Gibb (2007) stated that memory is on the cutting edge of research with scientists divided into two categories which are scemantic and episodic. Gibb stated that lack of nutrition has an effect on the brain as evidenced by malnutrition in pregnancy and infancy resulting in lower adult IQ, and researchers have found that supplementing normal diets with micronutrients resulted in significantly higher test scores. The modern diet is sorely lacking in vitamins and minerals and these micronutrients should be in our daily diets naturally (p.123).

MacDonald (2008) identifed the brain as an energy hog, because although it weighs very little (2%) it uses 20% of energy regardless if an individual is asleep or awake. If the brain lacks energy for more than 10 minutes, permanent damage occurs (p.28). The brain triggers physical signs of hunger when it notices a shortage of energy. To perform functions such as transporting nutrients, repairing cells, building and

distributing neurotransmitters, rewiring circuitry for learning, and keeping the electrical system maintained, the brain needs proper nutrition. Firing electrical signals in one's neurons and keeping the electrical system maintained consumes the most energy, and the brain fuel necessary is glucose which is a simple sugar (p.29). MacDonald explained that very low glucose levels weaken the brain. Low glucose levels prevent concentration, remembering, and the ability to pay attention; but, starchy tubers such as potatoes, turnips, and cassava, which can quickly be broken down into sugar, can spike up these levels since they are rich in carbohydrates.

The brain craves glucose and the best way to supply it for peak performance for a long period of time is to consume a regular supply of complex carbohydarates. MacDonald (2008) referred to complex carbohydrates as a time-release sugar pill. The source for these are fruits, vegetables, nuts, seeds, and grains. He suggested using the Glycemic Index (GI) which scores foods on how quickly they are broken down to glucose and the slower a food is broken down the healthier it is. Broccoli, artichokes, and asparagus are great examples of slow breakdown (p.33).

Other essential nutrients for a balanced brain are protein and fat. Protein slows down the absorption of glucose thereby keeping blood sugar levels from spiking. Proteins break down into amino acids which are the building blocks of the body and are key neurotransmitters critical for memory and attention. MacDonald (2008) suggested low-fat protein should be consumed at breakfast and lunch and names yogurt, peanut butter, and eggs as good choices. Although fat is thought of as bad, it is essential in many functions of the body and to the brain. However, omega 3 found in many fish is recommended and

is linked to healthier brains. Other good sources include seafood, avacados and olive oil (p.33). The mineral, iron, is essential for transporting oxygen to the brain and should be supplied through a diet which includes red meats. MacDonald recommended eating a variety of fruits and vegetables which contain antioxidants and play a vital role in nutrilizing free radicals which are harmful to cells (p. 34).

There are other foods and factors that affect the function of the brain and are consumed in what and how an individual eats. MacDonald (2008) discussed trans fats, which are liquid oils hardened by a process called hydrogenation, in which hydrogen has been added and although they are cheaper and have a longer shelf life, they are not friendly to the brain. When the brain uses trans fats to create neurons, they are not as strong and deter proper communication. According to MacDonald, caution should prevail in the use of caffeine found in various forms in a variety of products and should be consumed in moderation and best if traded for tea which releases caffeine in smaller amounts over a longer period of time. Moderate alcohol use such as a glass of wine with a meal does not pose a problem; but, heavy alcohol drinkers have shrunken brains and fewer neurons (MacDonald, 2008). Large meals do not give the brain more energy. Instead, this tends to lead to relaxation.

MacDonald (2008) suggested eating a variety of foods consisting of small, healthy meals at specific times such as breakfast, lunch, and dinner and snacks. He cautioned children and adolescents not to omit breakfast because without it they will spend the morning in a fog with low brain function. He concluded that what is good for the body is also good for the brain and suggested three simple dietary guidelines. These

are to choose complex carbohydrates over refined products. For example, choose whole grains and brown rice rather than colored, molded cereals. Secondly, include omega 3 fat found in salmon, tuna, sardines, anchovies, herring, and macarel and lastly, limit the amount of food one eats (p.36). A sample brain friendly diet plan can be found in the appendix.

Benefits of Proper Nutrition

Greene (2009) agreed that a lack of nutritional education is part of the problem of obesity. Campbell and Campbell (2006) stated that although people in the U.S. are barraged by diet books that become bestsellers, magazines that feature advice on nutrition, and TV and radio programs that have diet and health subjects as a staple, "very few people truly know what they should be doing to improve their health"(p.1). Campbell and Campbell (2006) argued that despite all the knowledge about health care, the health of Americans is failing. Young people are following in these footsteps. (p.3).

Hawke (1998) stated that the perfect diet does not exist. Hawke cautioned that children with learning disabilities or disorders be monitored for allergies and food sensitivities and be identified for treatment. These children may need a dietitian to plan proper diets for these food issues. Otherwise, children's diet should consist of whole grains, fresh fruits and vegetables, protein and dairy foods. These foods should not be treated with toxic sprays and should be properly cooked. Proper cooking refers to short cooking times at lower temperatures to retain nutrients and although there are no foods that ensure good health, eating a variety of foods which have been prepared in a simple,

but tasty way is a good beginning. Children should eat foods low in sugar, fat, salt and high in complex carbohydrates.

Florence et al. (2008) stated there have been few studies that examined quality of a diet on academic performance since most studies focus on malnutrition, hunger and micronutrient deficiencies. The usual study of a diet is focused on a specific nutrient or food and the role it plays in the diet; but one eats nutrients in combinations when one eats a meal (p.230). Florence et al. demonstrated that diet quality is important to academic performance because it links a child's educational attainment with his/her future income, socioeconomic status, and health. Taras (2005) argued that enough information connects diet and academics to warrant the development of school food service programs, policies, and nutrition curricula as well as guidance for parents of school children (p.199).

The Dairy Council of California (2009) discussed diet quality. Although socioeconomics plays a role in poor nutrition among the poor, all socioeconomic groups are at risk for poor nutrition because consuming enough calories does not equal good nutritional choices. The Dairy Council of California pointed to working parents who leave meal decisions to children which results in choices of foods that are high in fat, sugar, and salt. Some children may skip meals and others may eat what is available to satisfy their hunger. Just because a child looks healthy it cannot be assumed that child is well nourished. Any type of hunger will hinder a child's physical and mental preparedness to learn (p.1).

Breakfast and Academic Achievement

The United States Congress established the National School Lunch Program in 1946 for the purpose of safeguarding the nation's children's health and well-being (David, 2010). Since then, the programs have been expanded to include breakfast, after school, and summer options. The rationale was that by providing these programs to children schools could provide better opportunities for student success. In 2007-08, 31 million students participated in the lunch program nationwide (p.88). David explained that before the breakfast program, a study of low-income students showed one third were at nutritional risk with a history of low attendance, tardiness, anxiety, and aggression; but whithin 6 months of the breakfast program these students demonstrated an improvement in all the above-mentioned areas (p.89).

Barton and Coley (2010) stated that hunger impedes learning and the body and the mind need adequate nutrition. Barton and Coley cited research on underweight inner-city kindergarten children's low performance on test scores (p.20). Greene (2009) asserted that malnutrition during the critical growing period before the age of 3 can slow brain development and,therefore, affect readiness for preschool and high school academic performance . Lichtenstein and Ludwig (2010) argued that instruction in basic food preparation and meal planning skills should be a facet of a long-term solution to the problem of obesity (p.1857). They asserted that parents or caregivers cannot be expected to teach the children because they themselves do not know how to cook and instead rely on restaurants, take-out, frozen and packaged meals.

Murphy (2007) stated that interest in the improvement of student educational outcomes in the U. S. has focused on research from the 1980s and 90s which showed increased academic and cognitive performance by students who ate breakfast especially as they relate to recent studies that show negative consequences in children who skip breakfast. Hunger was also cited as a nutritional risk that added to a negative impact on school performance and overall health. Murphy noted that there is much evidence which shows both skipping breakfast and hunger are associated with increased obesity and that the trend of skipping breakfast increased as children got older. Research shows the importance of breakfast and the universal free school breakfast (USB) was implemented in the late 1990s for improving student outcomes (p.3).

In a press release by the USDA Food and Nutrition Service (#0079.99), Agriculture Secretary Glickman emphasized the fact that there is a clear link between nutrition and learning shown by research (p.1). He continued that studies done at the University of Minnesota, Harvard Medical School, and Massachusetts General Hospital indicated improvement in math grades, a reduction in hyperactivity, a decrease in absences and tardy rates, and general overall improvement among students who regularly ate breakfast (p.1). Tuft's University studies of low-income children who participated in the USDA's Breakfast Program showed significantly higher test scores on standardized tests than those who did not participate in the federal government program.

Murphy (2007) noted that since their implementation, some of these programs have been evaluated to discover the relationship between breakfast and student outcomes and provide strong evidence that indeed breakfast can contribute to improving student

learning. Murphy concluded that there is significant association between skipping breakfast and poor mental and general health. Specific illnesses such as dysmenorhea, dental issues, bowel problems, sleep problems are related to skipping breakfast. Murphy suggested there are other related health risks such as smoking, drinking, lack of exercise and stress and a greater risk of being overweight. This issue of weight is of extreme importance since public health authorities link poor diet and physical activity as a leading cause of preventable U. S. death. Murphy explained that eating a regular breakfast is associated with better nutrient intake and that expanding and enhancing school breakfast participation should continue.

In a New Jersey School Boards Association's newsletter (SBN,2012), emphasis was on the state's promotion of participation in the school breakfast program. In a 2011 report from Advocates for Children, in New Jersey, only 28% of eligible students took part in the program and the state ranked 46th in the nation in the percentage of students receiving a school breakfast. This ranking has prompted state officials to outline innovative approaches to increase participation such as allowing more students access to breakfast by adjusting school start times and bus schedules, serving breakfast in the classroom, create a grab and go mobile cart, and second chance breakfast offered at a later time. Various workshops are being offered to school districts which include best practice, addressing barriers, and success stories (SBN, 2012).

The International Reading Association (IRA, 2002) emphasized the importance of eating healthy and identifies breakfast and lunch as meals that contribute to a successful school day. Daily breakfast eaters have overall better school performance and better

attitudes than their counterparts (IRA, 2002). Murphy (1998) cited studies in Philadelphia and Baltimore that showed increases in math scores and decreases in absences and tardiness of participants of the breakfast program. Student reports also found these students more attentive during class with fewer behavioral and emotional problems. Murphy indicated similar results in the Harvard study which followed 133 students before the program and after implementation of the School Breakfast Program.

All students benefit from breakfast and should be encouraged not to skip it. According to the Minnesota Department of Children, Families, and Learning (1998), a universal breakfast program that was piloted in six elementary schools resulted in a general increase in learning and achievement. Educational time increased due to fewer class disruptions and discipline problems. Visits to the nurse due to headaches and stomachaches were reported to decrease.

Murray (1998) pointed to breakfast as an important factor in prevention of behavioral problems. Breakfast eaters pay better attention, have a longer attention span, are less fidgety, and are less disruptive. Although behavioral aspects of eating breakfast are important, Murray pointed to physiological reasons for breakfast, especially the correlation between learning and glucose. Learning enhancement is not just realized in children, but in all groups when blood glucose levels are raised. To maximize the potential for learning throughout the day, Murray suggested either feeding children smaller meals throughout the day or reorganizing the day so that easier or less intense subjects are taught at times when blood glucose levels are lower.

According to the Dairy Council of California (2009), hungry children suffer not only physical symptoms such as headache, muscle fatigue, stomach pain and sleepiness, but also psychological symptoms such as "anxiety, nervousness, anger, fidgety, hostility, indecisiveness, confusion and unhappiness are also common" (p.1). The Food Research & Action Center's Child Nutrition Fact Sheet; Breakfast For Learning (FRAC; 2009) linked breakfast and academics. The following statements were made:

1. Missing breakfast and experiencing hunger impair children's ability to learn.
2. Eating breakfast at school helps children perform better.
3. School breakfast improves student behavior and learning environments.
4. Universal school breakfast programs yield positive results.
5. Breakfast can improve children's diet.
6. Breakfast may reduce obesity risk.
7. Beliefs about breakfast can influence participation.

Murray (2008) argued that a nutritious breakfast is important for energy, concentration, and weight management. Breakfast is the first fuel a body receives to get the metabolism working and skipping it causes a sluggish metabolism. Breakfast increases energy and lowers cholesterol levels by providing soluble fiber in foods such as oatmeal, oat bran, citrus fruits and strawberries which are classified as breakfast foods. These foods were also shown to reduce heart disease. Breakfast eaters have better concentration, memory, and problem-solving skills. They eat fewer calories within the day by spreading them out in meals and snacks (p.3). Breakfast eaters who consume a

healthy breakfast do not experience sugar spikes, keeping blood sugar level and staving off cravings and hunger (p.4).

A nutritious breakfast should provide one fourth of the Recommended Daily Allowances (RDA) for protein, calcium, magnesium, zinc, vitamin A, vitamin 6, and iron daily (Dairy Council of California, 2009). Those students who eat breakfast have higher 24 hour nutrient intake; those who skip breakfast do not catch up later in the day on their nutrient RDA and fall an average of less than 2/3 of the nutrients for their RDA (p.1). Even though the research provides evidence of the importance of breakfast, 50% of children come to school hungry each day citing excuses such as no time, no availiability, or no appetite in the morning for breakfast (p.1).

Healthy Habits for Learning

Wolfe (2000) asserted that proper nutritional support is critical to maximize brain functioning and to enhance learning and that supporting the health of the whole child is essential for optimal achievement (p.54). Wolfe named a variety of healthy habits including, nutrition, as important components formed early in life to ensure normal growth and development. This physiological and neurological development promotes optimal learning defined as "the abilities to recall information, to problem solve, and to think critically" (Wolfe, 2000, p. 54).

All types of foods should be experienced for fueling healthy minds and bodies (Wolfe et al., 2000). Children should not be restricted in their food choices because this may compromise normal growth and development, although nutritious foods should be centerpiece. Wolfe encouraged the use of tools provided by the U.S. Department of

Agriculture such as My Plate to form a food plan. Scientists encourage a wide range of foods for nutrient sources that support brain function and neurotransmitter activity. These components are protein, fat, B vitamins, iron, choline, and antioxidants. Wolfe suggests following serving size, variety, balance, and moderation to ensure that students are receiving the brain nutrients. Examples are provided in the Appendix.

Nutrition Survey Data

The Centers for Disease Control and Prevention (CDC) developed the Youth Risk Behavior Surveilance System for students in grades 9-12 which gathers data through school-based surveys (Massey-Stokes, 2002). The 1999 data from this survey about young people's diets is as follows:

- Only 23.9 % of students had eaten five or more servings per day of fruits and vegetables (excluding French fries, fried potatoes, or potato chips) during the seven days preceding the survey; 18.0 percent drank three or more glasses per day of milk during the seven days preceding the survey.
- 42.7 % were trying to lose weight during the thirty days preceding the survey.
- 40.4 % had eaten less food, fewer calories, or foods low in fat to lose weight or to avoid gaining weight during the thirty days preceding the survey.
- 12.6% had gone without eating for more than twenty-four hours to lose weight or to avoid gaining weight.

- 7.6 % had taken diet pills, powders, or liquids without a physician's advice to lose weight or to avoid gaining weight.
- 4.8 % had vomited or taken laxatives to lose weight or to avoid gaining weight.

Massey-Stokes (2002) asserted that the key to effective learning is good health and that by eating properly and engaging in healthy behaviors as well, performance levels can elevate. Undernutrition is potentially present in both malnourished youth and misnourished youth,that is, those who have enough to eat but consume nutrient-deficient diets. Students who are even moderately undernourished may experience irritability, difficulty concentrating, and low energy levels which can hinder learning and "undernutrition can have lasting effects on cognitive development and academic performance of children and youth" (Massey-Stokes, 2002, p.286).

Nutrition Education Programs

Troccoli (1993) argued that there is a link between nutrition and children's cognitive development, cognitive performance, and ability to concentrate. Because of this link preschool and school-aged children need to receive proper and adequate nutrition (Troccoli, 1993). According to Triccoli, there is recognition that nutrition plays an important role overall; but many children are poorly nourished. The government is not oblivious to the research because there are numerous federal programs administered by the United States Department of Agriculture Food and Nutrition Service which supplements and educates families. The School Breakfast Program and the National School Lunch Program were designed to improve children's nutrition. The programs

were developed to serve breakfast and lunch to children of low income households and are either free or reduced-cost meals (Troccoli, 1993).

Christie (2003) stated that according to the 2002 School Breakfast Scorecard, 36 U.S. states participate in the School Breakfast Program which is funded by federal monies. There is, however, a growing concern not with who is participating, but with "what is being served and the nutritional habits of all children" (p. 341). Districts are contracting with soft drink and fast food providers in an effort to increase school revenue. To address this concern, a Healthy School Summit: Taking Action for Children's Nutrition and Fitness was held in 2002 consisting of a partnership of 30 national education, fitness, nutrition and health organizations representing 49 states and over 500 professionals. The U.S. Surgeon General identified concerns over the sale of candy, soft drinks, and fatty snacks in schools. The U.S. Department of Agriculture stated that studies show children who participate in school meal programs exhibit healthier eating behaviors, and the programs contribute to better health, and that "competitive foods undermine the nutrition integrity of the programs and discourage participation" (p. 342).

Fetro, Givens, and Carroll (2010) reported on a coordinated Tennessee school health program funded in 2000 in ten counties after recognizing the connection between health and academic achievement. Because of the pilot's success, state legislators expanded and funded the program statewide. They stated that this is not a new program to be added in schools, but a "framework for managing new and existing health-related programs and services in schools and surrounding communities" (p.32). Coordinated school health incorporates eight components related to health that have basically

functioned on an independent basis. They named these components as health education, physical education, school health services, counseling, psychological and social services, nutritional services, staff wellness, a healthy school environment and family and community invovement. This process is ongoing and they work by communicating, cooperating, coordinating, collaborating and integrating "developing seamless, blended programs and services with shared responsibility and accountability" (p.33). The best place for schools to begin their journey is to look at what is already in place (Fetro et al., 2010).

Improving Nutrition Education

Troccoli (1993) suggested the following steps to improve the nutrition initiative: (a) to develop materials for students and parents concerning both nutrition and the meal programs by dietitians and health professionals, and (b) to enlist parents to work with schools and encourage their children's participation in the programs. Nutritionists suggest school meals should be higher in fiber and lower in fat, cholesterol, sodium, and sugar. The average calories in a meal coming from fat should average 30% (Troccoli, 1993).

Lack of sufficient attention on nutrition education by schools, administrators, states, and the federal government is evident. Lichtenstein and Ludwig (2010) argued that instruction in both basic food preparation and meal planning should be part of a long-term solution. They argued that parents or caregivers cannot be expected to teach the children because they themselves do not know how to cook and rely on restaurants, take-out, frozen and packaged meals. Greene (2009) agreed that a lack of nutritional education is part of the problem. Campbell and Campbell (2006) stated that although people in the

U.S. are barraged by diet books that become bestsellers, magazines that feature advice on nutrition, and TV and radio programs that have diet and health subjects as a staple, few actually know how to improve their health. Campbell and Campbell explained that despite all the knowledge that is accessible and all the money spent on health care, the health of Americans is failing. Although the issue of obesity has come to the forefront recently, the connection has not been fully made that the lack of nutrition education plays a major role in this national problem. Many individual states and local districts are beginning to address this issue.

According to The Nation's Restaurant News (2002) "results of the survey suggest that teacher's efforts could be improved through more focused in-service training in the use of active learning strategies, of weaving nutrition lessons into other subjects and tips for involving families in the educational process" (p.14). The Nation's Restaurant News stated that although teachers responding to a survey on regular classroom nutrition education offered some type of instruction, they fell short of the 50 hours per year suggested as being necessary for identifying impact on students. The average number of hours elementary school teachers spent teaching nutrition was 13 per year. Teachers who were wholeheartedly supported by their administrators were found more likely to engage in active learning strategies, such as working with school food service departments and parents on nutrition activities according to the report (p. 14).

Story, Lytle, Birnbaum, and Perry (2002) asserted that nutrition education not only can help young people attain the knowledge and skills for a healthy lifestyle, but also that schools are the perfect settings because most subjects can adapt nutrition

education into material taught. Schools provide children the chance to practice what they learn since most children eat at least one of their three meals in a school setting. Story et al. also promoted peer education as a strategy for school-based nutrition education classes. Peer education is a strategy long used by health educators to promote change in adolescent behavior. This strategy has been used in programs such as violence prevention, bullying prevention, substance abuse, and in support groups for chronic diseases. (Story et al., 2002).

Adolescent nutrition education programs need to be planned differently than others because the cognitive and social developmental processes and changes include a shift toward abstract thinking and changes in adolescence. Some of these developmental changes include problem solving skills, questioning adult authority, more autonomy from parents and increased reliance on peers as a source of identity, support and normative behavior. (Story et al., p. 121). Because of these developments, Story et al. suggested peer education can be a strategy to engage and motivate adolescents and can promote healthful food choices among this group.

Massey-Stokes (2002) stated that the task of health promotion requires understanding health behavior and transforming knowledge about behavior into useful strategies that will enhance health (p.5). Gimme Five!, a school-based nutrition intervention was created to address factors that contribute to 4th and 5th grade children's inadequate consumption of fruits and vegetables (p.5). Although an elementary school-aged children's program Gimme Five! can be adapted for use in middle and high school

students, Massey-Stokes proposed using social cognitive theory for effecting behavioral change. Such a program emphasizes:

- Increasing the value students place on health, wellness, and sound nutrition.
- Providing students multiple opportunities to taste healthy foods, including foods they have not tasted before.
- Collaborating with parents, school personnel, health professionals, and others to overcome barriers to healthy eating.
- Using influential role models, including peers, to demonstrate healthy eating practices.
- Providing incentives (e.g., verbal praise and small rewards) to reinforce messages.
- Helping students develop relevant life skills for and self-efficacy in planning meals, preparing foods, reading labels, and making wise food choices through observation and hands-on practice.
- Enabling students to critically analyze their own eating behaviors, set realistic goals for changes in their eating habits, monitor their progress in attaining those goals, and reward themselves for achieving their goals (CDC, 1996).

Pond (2001) highlighted programs geared for younger children. These programs are taught by food service professionals in the classroom through a series of coloring books focusing on the food groups, the food guide pyramid and diet. Another program to

encourage nutritious food choices is a complete lunch package which was designed for girls but has caught on with both genders. This meal exceeds federal nutrition standards and consists of yogurt, soft pretzel, vegetable sticks, a snack, fresh fruit and lowfat milk. Some schools include the salad bar and to keep costs down the "grab and go" lunch is offered a few days a week.

Matheson et al. (2002) researched preschool children's perceptions and experiences with food. "Healthy eating habits are essential for the normal growth and development of preschool children and to prevent nutrition-related diseases later in life" (p.85). Matheson et al. suggested that healthy food habits that develop during this period carry over to school age and adolescence, and the nutrition education they receive at this critical period may provide the foundation for their healthy eating habits for a lifetime. Matheson et al. also suggested nutrition education programs for this group should be based on the daily experiences children have with food, rather than on abstract understanding. Since developmental psychologists believe that children learn through play, a play-based program should be the strategy used for this group.

Summary

Although much research can be found on nutrition and the importance it plays in learning, students in a Foods I class still had problems understanding the nutrition education material. The purpose of this study was to investigate the benefits of a 4-week nutrition intervention unit in the Foods I classes taught using constructivist teaching methods implemented to provide students with both information and valuable skills

which could positively impact student's health and student learning. Section 3 is an explanation of the methods used to gather original data.

Section 3: Research Method

Introduction

Nutrition education has been an integral component of all the Foods classes at the high school level. However, the changes in the programs districtwide caused the need for changes in the high school Foods classes. Elimination of the Foods classes at the elementary and middle school level presented the problem of limited nutrition knowledge of students taking the Foods I classes. Students seemed to struggle to understand the information. It was decided by the supervisor and educators of the Family and Consumer Sciences Department that modification to the nutrition component of the class was necessary to ensure that students truly understood the material taught and, therefore, would implement the information into their dietary food choices.

The 4-week nutrition intervention unit was designed to cover the principles and science of nutrition. Students would first be introduced to nutritional terminology. The nutrition intervention unit incorporated the nutrients and their functions, metabolism and calories, meal planning and serving size, food labels, and consumerism. This unit was taught in a constructivist classroom where learning is a result of the connection a student makes between new information and previous knowledge. The teacher worked with students and facilitated learning by guiding, leading, and coaching rather than simply dispensing information. Students built or scaffolded their learning through questioning, tasks, resources, challenges, and other classroom activities, and students were engaged in deep processing of ideas rather than rote memory activities (Vermette et al., 2001). Students worked on cooperative problem-solving and collaborative projects which

provide shared opportunities where students can elaborate and build on their knowledge through social interaction. Motivation was enhanced by raising student curiosity and connecting the knowledge to real world situations. Currently, the New Jersey State Core Content Standards call for every course offered to enhance student learning through critical thinking. Students in this course would "categorize, hypothesize, generalize, synthesize, apply, analyze and elaborate issues of content" (Vermette et al., 2001, p. 9).

In keeping with the constructivist perspective, the teacher acted as a facilitator and the students were the designers of how the material or knowledge would be shared with fellow classmates. For example, students would cooperatively work in groups to present the material on nutrients to their fellow classmates. Each group consisted of two students and a nutrition topic was assigned to each group. Resource materials such as books were provided for the research project. Library and computer lab access were also provided, and students were given a time frame to collect information, analyze and format it into a presentation for the class. The presentations were delivered to the class using basic guidelines to give the students flexibility and creative permission. Classmates were given the opportunity to interpret, question and share knowledge. Students also had the opportunity to complete individual personal analysis of their eating habits and explore issues that contribute to those habits. Students used food replicas to explain portion control and calorie analysis in their food choices.

Research Design

The design of this study involved an exposure of a group (Foods I classes) to a treatment (a 4-week nutrition intervention unit using constructivist teaching methods)

followed by a measure. This design included a pretest measure followed by a treatment and a posttest for a single group (Creswell, 2003). The quantitative data were used to explore whether material presented in the intervention increased student knowledge of basic nutrition. A survey was used to collect data and to analyze student satisfaction of the nutrition intervention unit in the Foods I classes. The pre and posttests were used to analyze the knowledge component, and the survey would provide data for the behavioral component of the study.

A pretest was administered to the participating Foods I students at the beginning of the 4-week intervention unit to determine their nutrition content knowledge, and a posttest was administered at the end of the unit to determine the increase or growth in nutrition content knowledge. The same test was used for the pre and posttests. The traditional curriculum does not incorporate a pre and posttest and therefore does not measure growth in students' nutrition knowledge. The test consisted of 50 items in the following four general areas covered in the intervention unit: food nutrients and functions, metabolism and calories, meal planning and serving size, food labels, and consumerism. The test consisted of true and false statements, multiple choice answers to statements, and word choice answers. Twenty-five completion statements would require an answer from choices A-E. The 25 statements were formatted into three groups of four questions requiring an answer choice from letters A-E . There were 15 multiple choice questions and 10 true and false statements.

The test was developed by the Family and Consumer Sciences teachers for the nutrition intervention unit and designed to cover the content knowledge areas addressed

in the intervention. The test was field tested with the Foods II classes and student analysis was incorporated in the revision of the test. The test was developed to fit into a 43 minute class time frame. The same test was used before and after the 4-week nutrition intervention unit and the data were analyzed.

A survey was developed by the Family and Consumer Science educators to measure student attitudes and behavioral changes following the 4-week nutrition intervention unit. The purpose of the intervention was to provide students with easy to understand and easy to implement nutrition content knowledge. This Likert style survey consisted of 15 statements. This self-administered survey was designed to evaluate students' perception of effectiveness of the intervention by implementation. The research data collected were used to evaluate and possibly modify the intervention as needed. The survey consisted of statements about students' attitudes and behavior changes after studying the nutrition intervention unit and used a continuous scale from *strongly agree* to *strongly disagree*.

The quantitative design that was used provided numeric opinions of the population. Data collection consisted of a Likert-type survey with a continuous scale from *strongly agree* to *strongly disagree*. This survey was distributed to the 82 students who participated in the nutrition education program at the end of a 4-week period in the Foods I classes. A pretest before the nutrition program intervention and a posttest after the program were administered to students at specified times. This preexperimental design was a one-shot case study at the high school level. This design did not have a control group and studied a single group with intervention during the experiment

(Creswell, 2003). I investigated the impact a 4-week nutrition concentration component of the Foods I classes had on students' knowledge of nutrition, use of constructivist teaching strategies in teaching nutrition, and perception of behavioral change in daily food choices.

All students registered in the Foods I classes participated in the study since this intervention unit was a part of the class. A parent consent form for permission to participate in the survey was not necessary. The self-administered survey was designed to evaluate students' perception of the effectiveness of the intervention, and the research data collected were used to evaluate and possibly modify the class as needed.

A colleague and I administered the survey at the end of a 4-week period to all the Foods I classes that participated in the nutrition education program. A pretest before the nutrition intervention unit, and a posttest after the program were administered to students at specified times and were administered in the classroom. Follow-up consisted of ensuring that every student enrolled in the Foods I classes had an opportunity to participate in the study. Students who could not participate on the date the survey was administered were able to participate during the activity period on Wednesday of every week, which is a 43 minute period at the end of the day for various school activities. Students were given arranged class time to participate, if necessary.

The research questions were:

Research Question 1: Will students demonstrate an increase in nutrition knowledge following a 4-week nutrition concentration designed using constructivist

teaching strategies component in the Foods classes as measured by pretest and posttest scores?

$H1_0$: There is no significant difference in student nutrition knowledge following a 4- week nutrition concentration component in the Foods classes as measured by pretest and posttest.

$H1_A$: There is a significant difference in student nutrition knowledge due to a 4-week nutrition concentration component in the Foods classes as measured by pretest and posttest.

Research Question 2: Will students perceive a better knowledge of nutrition due to constructivist teaching strategies used in the 4-week intervention?

$H2_0$: There is no perceived change in the knowledge of nutrition due to constructivist teaching strategies used in the 4-week intervention.

$H2_A$: There is a perceived change in knowledge of nutrition due to constructivist teaching strategies used in the 4-week intervention.

Research Question 3: Will students perceive a positive change in their food choices due specifically to a 4-week nutrition concentration component in the Foods classes?

$H3_0$: There is no perceived change in student food choices due specifically to a 4-week nutrition concentration component in the Foods classes.

$H3_A$: There is a perceived change in student food choices due specifically to a 4-week nutrition concentration component in the Foods classes.

Reliability

For reliability, I used a test-retest. The same test was administered before and after the 4-week nutrition intervention program with 82 students in the Foods I classes. Since the time frame of the test-retest is 4 weeks, it was not too short or too long a period that would affect the answers. Reliability was expressed numerically as a coefficient. The coefficient should be high indicating that the effect of errors of measurement has been reduced. According to Gay (1992) test-retest reliability requires a group to take two tests and is determined by correlation (p.169).

The procedure for determining test-retest reliability was as follows:

- Administer the test to the Foods I classes.
- After the 4-week nutrition intervention unit, administer the same test to the same students in the Foods I classes.
- Correlate the two sets of scores.
- Evaluate the results.

The resulting coefficient should be high for reliability of the test.

Reliability will also be expressed in terms of the standard error of measurement using the formulas:

$$SEm = SD / 1 - r$$

where SEm = standard error of measurement

SD = the standard deviation of the test scores

r = the reliability coefficient

The survey that was used in this study included a Likert scale where responses were scaled along a continuum. The students responded to each statement using *strongly agree*, *agree*, *undecided*, *disagree*, and *strongly disagree*. Each response was given a point value and the point values will be indicative of a positive or negative attitude.

All testing was conducted in a school setting in the Foods classroom and laboratory where students were familiar with the surroundings and procedures for regular test taking. Field-testing was used to reestablish reliability by testing the instrument with the Foods II classes and incorporating their comments to improve or revise for clarity, improvement or elimination of test and survey items.

Validity

Content validity was addressed through item and sampling validity. The pre and posttest was designed to measure knowledge of nutrition taught in the 4-week intervention unit. The intervention was designed to cover the principles and science of nutrition. Basic components of the nutrition intervention unit included the following: nutrients and functions, metabolism and calories, meal planning and serving size, food labels and consumerism.

Questions that addressed validity were: Will students learn better if they understand the connection to good nutrition? Does nutrition education affect student achievement? Did the nutrition intervention unit increase student understanding? How did the teaching strategies impact student understanding of nutrition? Will students use their nutrition knowledge on a daily basis to make better dietary choices? Will parents,

teachers, and administrators understand the relationship of good nutrition to student learning and achievement?

The test was developed by the Family and Consumer Sciences teachers for the nutrition intervention unit and designed to cover the content knowledge areas addressed in the intervention. The test was field tested with the Foods II classes and student analysis was incorporated in the revision of the test. The test was developed to fit into a 43 minute class time frame. The content validity was aligned with New Jersey Core Curriculum Content Standards.

Face validity was verified by having the survey examined by experts to ensure that it is a good measure of the content being surveyed. Construct validity was determined using the survey. A Likert-type survey was developed by the Family and Consumer Science educators to measure student attitudes and behavioral changes following the 4-week nutrition intervention unit. The purpose of the intervention was to provide students with easy to understand and easy to implement nutrition content knowledge. The self-administered survey was designed to evaluate students' perception of effectiveness of the intervention and satisfaction by implementation.

The independent variables in this study were the 4-week nutrition intervention unit in the Foods I course at the high school and the application of constructivist teaching methods used in the intervention. The dependent variable was the effect or difference in scores between the pretest and posttest. The one group repeated-measures satistical test was used in this study for hypothesis testing.

Pre-Experimental Design

One-Shot Case Study

This design involved an exposure of a group to a treatment followed by a measure. (Creswell, 2003).

Group A X----------O

One Group Pretest-Posttest Design

This design included a pretest measure followed by a treatment and a posttest for a single group

(Creswell, 2003).

Group A O1_____X_____O2

Statistical Analysis

The quantitative data were analyzed to determine whether material presented in the intervention increased student knowledge and understanding of basic nutrition. There should be a statistically significant difference in the posttest scores which would indicate that students acquired and understood the information. The one group repeated-measures design was used for the *t* tests. This design used the same individuals in both treatments, a pretest and posttest. This design was well-suited for the research because it looked at changes that took place over time and eliminated problems that may be caused by individual differences such as age, IQ, and gender. The repeated-measures *t* test was used in computing the differences between the pretest and posttest scores:

$D = X_2 - X_1$. The letter *D* identifies the data as difference scores. The sample mean is identified as Md, and the population mean is identified with the symbol . The estimated standard error is identified as smd and provides a measure of how much difference between the sample mean and population mean is reasonable. The t statistic allows the researcher to use the sample mean as a basis to test the hypothesis about the population mean (Gravetter & Wallnaur, 2005, p. 278):

$$t = \frac{M_D - \mu_D}{S_{M_D}}$$

The data from the survey were used to determine whether the intervention impacted students' perception of behavioral changes relating to healthy eating. Student answers on the survey indicated whether or not content knowledge is used to enhance daily food and purchasing choices. Changes in student attitudes may be impacted by the intervention and indicated on the survey as well. These changes in attitude and behavior would be a positive indication for the intervention. Students must understand nutrition to implement behavioral and attitudinal changes in daily living. The survey used in this study was a Likert scale where the students responded to each statement using the choices: *strongly agree*, *agree*, *somewhat agree*, *disagree*, and *strongly disagree*. Each response was given a point value and the point values will be indicative of a positive or negative attitude (Appendix B).

Participants

The pretests and the posttests were administered to the same 82 (*N*=82) students in the Foods I classes. Students enrolled in the Foods I classes were both male and female

ranging in age from 14-18 years. Students were enrolled in the Foods I classes through the guidance department either during the regular scheduling of classes that takes place in the third marking period of the school year or in the beginning of the school year when schedules are modified for various reasons. There was no prerequisite for the Foods I class since it is the basic Foods class and serves as a prerequisite for other foods classes. The class sizes ranged from an average class of 16 to an over-sized class of 24 students. Student enrollment was open to any student who showed an interest in the course. The Foods I course is considered an elective, and students have a choice of various electives to fulfill their requirements in the area of Fine and Performing Arts. As a result, the students in the Foods I classes were made up of males and females, various ethnic backgrounds and races, and various educational levels.

Researcher's Role

I am a teacher in the Family and Consumer Sciences Department at the high school where the research took place. I revised the curriculum and taught the course. I administered all assessments and performed all the analysis. The research site was the Foods classroom and a parent consent form was not necessary for participation in the study. School administration was informed of the study with detailed information as to its purpose and outcomes.

Materials

Specific materials used in the study included materials typically used in teaching the Foods courses. These materials included graphic organizers, student books, workbooks, and games. Materials were retrieved from the library to enhance or provide

additional information. These were books, magazines or computer-generated research and information. Quizzes and hands-on labs may be incorporated as additional resources.

Data Collection and Recording Tools

The instruments used in this survey design quantitative study were a pretest and posttest and a Likert-type survey. The self-administered survey was designed to evaluate students' perception of effectiveness of the course at the end of the 4-week nutrition intervention unit. Reliability and validity needed to be re-established through field testing the instrument with students from the Foods II classes and incorporating their comments to improve or revise for clarity. A pretest before the nutrition program intervention and a posttest after the concentration were administered to students at specified times and took place in the classroom.

Data Collection Procedure

Evaluation of student progress was ongoing and a pretest at the beginning of the 4-week class and posttest at the end of the 4-week intervention unit were used to assess changes in student content knowledge. Data analysis of student achievement was used to determine success rates. Grade 12 Cumulative Progress Indicators for Consumer, Family and Life Skills and Comprehensive Health and Physical Education were used in assessing student achievement from the applicable strands listed under each content area.

Data Analysis and Interpretation Plan

Two insturments that were used in this quantitative design were a pre and posttest and a Likert-type survey. The measures were used to provide data to analyze the success of the nutrition intervention in the Foods I classes. Statistical analysis were used

to analyze and interpret data. Data for each class was collected and organized for entry into the data file using SPSS. Means were calculated for the pretest and posttest for each class. Data were not matched from pretest to posttest. Data were analyzed using a *t* test with an alpha level of .05. A two-sided test was used to determine significant improvement. The repeated-measures *t* formula in this study looks at the difference in scores of the pretest and the scores in the posstest. The difference scores for the population is used to test the hypothesis.

A student survey was used to access information on behavioral changes due to the intervention. The data from the survey were used to determine whether the intervention impacted students' perception of behavioral changes relating to healthy eating. Student answers on the survey indicated whether or not content knowledge was used to enhance daily food and purchasing choices. Changes in student attitudes were impacted by the intervention and indicated on the survey. These changes in attitude and behavior would be a positive indication for the intervention..

Each survey response was tallied by statement and responses to the statements. The response numbers of statements and responses were entered onto a master tally sheet. The number totals for each statement under responses of *strongly agree*, *agree*, and *somewhat agree* will be indicative of a positive attitude and the numbers for each response of *disagree* or *strongly disagree* will be indicative of a negative attitude.

Threats to Validity

A threat to the quality of this study may be my bias as I am also a teacher in the Family and Consumer Sciences Department at the school where the study was conducted

I taught several of the Foods I classes that were participants in the study and I am the researcher in the study. I used the test-retest method for reliability. The same test was administered before and after the 4-week nutrition intervention unit with 82 students in the Foods I classes. Since the time frame of the test-retest was 4 weeks, it was not too short or too long a period that would affect the answers.

Summary

The purpose of this study was to investigate the benefits of a 4-week nutrition intervention unit in the Foods I classes taught using constructivist teaching methods implemented to provide students with both information and valuable skills which could positively impact students' health and student learning. Section 3 is an explanation of the methods used to gather original data. Section 4 is a report of the results. Section 5 is an anlaysis and interpretation of the results.

Section 4: Results

Introduction

A 4-week nutrition intervention unit taught using Constructivist teaching methods was implemented in the Foods I classes in order to ascertain whether or not there was a significant difference in scores from a pretest to a posttest. The pretest was administered before the 4-week intervention unit to all students in the Foods I classes to determine basic nutrition content knowledge and the posttest was administered at the conclusion of the intervention to determine significant increase in basic nutrition content knowledge. This section is a report of the results of the quantitative inquiry into the 4-week nutrition intervention unit.

Two measures were used in the study, a pre and posttest and a survey. Analysis of the survey was used to measure student attitudes and behavioral changes following the nutrition intervention. The self-administered survey was designed to evaluate students' perception of effectiveness of the intervention and was used to evaluate and possibly modify the intervention as needed.

Research Questions

Research Question 1: Will students demonstrate an increase in nutrition knowledge following a 4-week nutrition concentration designed using constructivist teaching strategies component in the Foods classes as measured by pretest and posttest scores?

$H1_0$: There is no significant difference in student nutrition knowledge following a 4-week nutrition concentration component in the Foods classes as measured by pretest and posttest.

$H1_A$: There is a significant difference in student nutrition knowledge due to a 4-week nutrition concentration component in the Foods classes as measured by pretest and posttest.

Research Question 2: Will students perceive a better knowledge of nutrition due to constructivist teaching strategies used in the 4-week intervention?

$H2_0$: There is no perceived change in the knowledge of nutrition due to constructivist teaching strategies used in the 4-week intervention.

$H2_A$: There is a perceived change in knowledge of nutrition due to constructivist teaching strategies used in the 4-week intervention.

Research Question 3: Will students perceive a positive change in their food choices due specifically to a 4-week nutrition concentration component in the Foods classes?

$H3_0$: There is no perceived change in student food choices due specifically to a 4-week nutrition concentration component in the Foods classes.

$H3_A$: There is a perceived change in student food choices due specifically to a 4-week nutrition concentration component in the Foods classes.

Testing Procedures

The intervention was designed to cover the principles and science of nutrition. Students were introduced to nutritional terminology. Basic components of the nutrition

intervention unit covered these areas: nutrients and functions, metabolism and calories, meal planning and serving size, and food labels and consumerism.

The pretest was administered to 82 (*N*=82) students in the Foods I class and then collected by the class teacher before the intervention, and the posttest was administered to the same 82 (*N*=82) students and then collected at the conclusion of the intervention. Both the pretest and posttest were placed in an envelope and given to me immediately after administration. All pretests and posttests were scored by me using a Scantron machine. Each of the administered tests was scored on a 100 point scale, and each question on the pretest and posttest was designed to have either a correct or incorrect answer. An answer was incorrect if it was marked wrong or left blank.

Students used a 50 question scantron sheet to complete both pretests and posttests. The scantron sheet is composed of five rectangular pencil fill-in blanks for each corresponding numbered question or statement on the test. I used the school Scantron machine for the grading process which scans the sheets and marks each individual question correct or incorrect and tallies correct answers which are printed on the scantron sheet. The teacher's answer key was scanned through the machine initially, and each consecutive scantron sheet was graded by question according to the answers on the key. The tests were categorized as a pretest given to students before the 4-week nutrition intervention unit and a posttest given to the same students after the 4-week nutrition intervention.

I determined the effectiveness of the treatment based on the SPSS software and the significance level which compared the pre test and posttest grades of the students. If $p>0.05$, I accepted the null hypothesis. If $p<0.05$, the null hypothesis was rejected.

Table 1

Independent Samples Test

	Levine's Test for Equality of Variances		*t*-test for Equality of Means				
	F	*Sig*.	*t*	*df*	*Sig*. (2-tailed)	Mean of Difference	Std. Error of Difference
SCORE Equal Variances assumed	2.445	.120	2.842	162	.005	6.20732	2.18426
Equal variances not assumed			2.842	155.491	.005	6.20732	2.18426

Table 2

t *Tests for Equality of Means (95% Confidence Interval of the Difference)*

	Lower	Upper
SCORE Equal variances assumed	1.89402	10.52061
Equal variances not assumed	1.89266	10.52197

Table 3

Group Statistics

Test	*N*	Mean	Std. Deviation	Std. Error Mean
SCORE 2	82	70.8537	15.35033	1.69516
1	82	64.6463	12.47355	1.37747

The obtained *t* value of 2.842 falls in the critical region. The null hypothesis is rejected. The students did demonstrate a significant difference in nutrition knowledge following a 4-week nutrition concentration component in the Foods I classes as measured by pretest and posttest scores.

Survey Procedures

The survey that was used in this study was a Likert scale where the students responded to each statement using the choices: *strongly agree*, *agree*, *somewhat agree*, *disagree*, and *strongly disagree*. Each response was entered onto a master tally sheet that was designed with the same responses as previously described to each of the 15 statements on the survey. Responses of *strongly agree*, *agree*, and *somewhat agree* will be indicative of a positive attitude, and responses of *disagree* and *strongly disagree* will be indicative of a negative attitude.

The survey was administered in the school setting in the Foods classroom and laboratory where students are familiar with the surroundings and procedures for regular test taking. Eighty-two students were given the survey approximately 1 week after the nutrition intervention posttest. Students were given the survey in the regular 43 minute

class period and were given the directions for proper completion. Students were asked not to write their names on the survey so as to remain anonymous. The teacher explained the purpose of the survey and asked students to answer honestly. All students had the opportunity to complete the survey. Students submitted the completed surveys to the teacher. The teacher collected individual class surveys and presented them to me after every student had the opportunity to complete the survey.

Table 4 shows the data for the 82 students responding to the survey. The numbers designate either a positive response or a negative response. The numbers of the statements are grouped to the corresponding research question, and the results are summarized below the statement groups. The data were compiled as follows.

Statements 1-5 on the survey related to Research Question 2: Will students perceive a better understanding of nutrition due to constructivist teaching strategies used in the 4-week intervention?

Table 4

Statements 1-5

Statement	Positive Attitude	Negative Attitude
1. Nutrition education should be taught in school.	82	0
2. Nutrition education should be taught well before the high school years.	73	9
3. This nutrition component was easy for me to understand.	77	5
4. I am more aware of how important good nutrition practices are to my health.	77	5
5. I feel I received important information on nutrition that I could use every day.	71	11

Results of survey statements 1-5:These were the findings of students answering positive to the statements on nutrition education and their feelings on the ease of understanding the nutrition component. All 82 students felt that nutrition should be part of the school curriculum and 73 students felt that nutrition education should begin before the 9th grade. Students understood the importance of nutrition knowledge and that it impacts on their health. Students felt the nutrition component was easily understood. For Research Question 2 the response of *yes* was indicated as to whether students will perceive a better understanding of nutrition.

Data compiled on Statements 6-12 on the survey related to Research Question 3: Will students perceive a positive change in their dietary choices due specifically to a 4-week nutrition concentration component in the Foods I classes?

Table 5

Statements 6-12

Statement	Positive Attitude	Negative Attitude
6. I try to eat breakfast every day.	68	14
7. I choose nutrient dense foods for breakfast.	62	20
8. I try to pick foods from all the nutrient groups daily.	60	22
9. I try to eat three balanced meals every day.	60	22
10. I keep my sugar level even all day by eating nutritious snacks.	48	34
11. I try to control my intake of sugar by drinking less sugary beverages.	48	34
12. I try to have the equivalent of 8 glasses of water per day in my diet.	55	27

Results of survey statements 6-12: Students had a positive response to statements 6-9. These statements were about students' perception of a positive change in their food choices due specifically to the nutrition component of the class. They indicated the inclusion of a daily breakfast and better choices for the meal, as well as eating three meals with food choices from all of the appropriate food groups. However, as noted for Questions 10-12, a positive response seemed more difficult for student implementation. These were controlling sugary beverages and making an effort to consume the proper amount of water daily. Research Question 3: Will students perceive a positive change in their dietary choices due specifically to a 4-week nutrition concentration component in

the foods classes? had a positive response. Statements 13-15 on the survey related to Research Question 2.

Table 6

Statements 13-15

Statement	Positive Attitude	Negative Attitude
13. I read package labels.	50	32
14. I read ingredient panels to determine what the food contains.	49	33
15. I make better food choices because I feel I understand labels and how to read them.	50	22

Results of survey statements 13-15: Students' positive numbers to statements 13-15 indicated that students did understand the information on nutrition due to the constuctivist teaching strategies used in the intervention. Therefore, Research Question 2 is answered, yes.

Conclusion of Survey Data

The data gathered on the survey produced a positive result to Research Questions 2 and 3. Students knowledge of nutrition increased following the constructivist ,4-week intervention. Section 5 is an analysis of the results.

Section 5: Discussion, Conclusions, and Recommendations

Overview

At the end of each school year, when students have completed the final exams, teachers have an opportunity to reflect on various issues. During such a period, teachers of the Family and Consumer Sciences Department identified an issue that was problematic. The third marking period in the Foods I classes is focused on nutrition education. The teachers noticed that students had problems understanding nutrition and some student comments on the end of the year evaluations indicated a negative perception of nutrition. The teachers were given the opportunity to investigate the problem. Alternative teaching methods were discussed and the constructivist teaching method would be implemented for the nutrition education component of the course.

The purpose of this study was to investigate the benefits of a 4-week nutrition intervention unit in all the Foods I classes using constructivist teaching methods. The participants in the study were students enrolled in the Foods I course. The classes were composed of all four grade levels at the high school, 9-12. The students were aged 14-18 consisting of 82 females and males of various educational levels and ethnic groups.

The quantitative design used pre and posttest and a survey. A pretest was administered to all participants in the Foods I classes before the intervention unit and a posttest at the conclusion of the intervention unit. The survey was administered to determine whether there was a conscious change to aparticipant's personal diet, specifically to making healthier food choices. The SPSS data analysis program indicated

an increase in the posttest student scores and the survey implicated a positive perception of change in nutrition behavior in daily food choices by students.

Interpretation of Findings

Research Question 1

The tests were categorized as a pretest given to students before the 4-week nutrition intervention unit and a posttest given to the same students after the 4-week nutrition intervention. I determined the effectiveness of the treatment, and the significance level which compared the pretest and posttest grades of the students. If the significance level was greater than the .05 alpha level set for each test to identify the critical region, I would fail to reject the null hypothesis that there is no significant difference in student nutrition knowledge following a 4-week nutrition concentration component in the Foods I classes as measured by pretest and posttest. If the significance level was less than .05, I would reject the alternative hypothesis that there is a significant difference in student nutrition knowledge due to a 4-week nutrition concentration component in the Foods I classes as measured by pretest and posttest. The obtained *t* value of 2.842 falls in the critical region. Therefore, the null hypothesis is rejected. The students demonstrated a significant difference in nutrition knowledge following a 4-week nutrition concentration component in the Foods I classes as measured by pretest and posttest scores.

The nutrition intervention unit was designed to incorporate constructivst teaching methods for the purpose of not only increasing knowledge, but also incorporating that knowledge into their daily lives. A survey was administered in the school setting in the

Foods classroom and laboratory where students are familiar with the surroundings and procedures for regular test taking. Eighty-two students were given the survey approximately 1 week after the nutrition intervention posttest. Students were given the survey in the regular 43 minute class period and were given the directions for proper completion. Students were asked not to write their names on the survey so as to remain anonymous. The teacher explained the purpose of the survey and asked students to answer honestly. All students had the opportunity to complete the survey. Students submitted completed survey to the teacher. The teacher collected individual class surveys and presented them to me after every student had the opportunity to complete the survey. The data for the 82 students responding to the survey corresponding to Research Questions 2 and 3 are individually stated and summarized.

Research Question 2

The survey statements on nutrition education and student feelings on the ease of understanding the nutrition component relating to constructivist teaching methods were positive. Students also indicated that nutrition education should be part of the school curriculum and that nutrition education should begin before the 9th grade. Students understood the importance of nutrition knowledge and the impact it has on their health. Students felt the nutrition component was easily understood. Survey questions relating to consumerism also had positive responses indicating an understanding of nutrition knowledge.

Research Question 3

Students had a positive response to the statements referencing Research Question 3. They indicated the inclusion of a daily breakfast and better choices for the meal, as well as eating three meals with food choices from all of the appropriate food groups. However, controlling sugary beverages and making an effort to consume the proper amount of water daily, a positive response seemed to be more difficult for student implementation. The data gathered on the survey produced a positive result to Research Questions 2 and 3. Students perceived a better understanding of nutrition due to constructivist teaching strategies used in the intervention and perceived a positive change in their dietary choices due specifically to the nutrition component.

Results of the study can be used as a foundation for applying strategies and actions to promote positive outcomes and positive social change. Students may use the nutrition knowledge and skills by transitioning these to the challenges of the real world. By providing these life-based skills, students may enhance their quality of life. This study could be a best practice model for the state of New Jersey which districts throughout the state could utilize for research, data, and possible implementation.

Recommendations

Given the social issues facing society, information is important. The sources for this information should be reliable and reputable. Campbell and Campbell (2006) asserted that information can be cluttered by junk science and food industry propaganda and even inaccurate information (p.1). According to Campbell and Campbell, there is no distinction between government, industry, science, and medicine, and, therefore, no

distinction between making a profit and promoting health. The result is massive misinformation. This also results in Americans paying for research through tax dollars and paying for preventable diseases through health care costs (p.8). More convesations are needed in addressing the issues discussed in this study and other related issues.

The correlation between what students eat and how they learn has been documented. Christie (2003) concluded that teachers should not be asked to teach students who come to school without his or her brain. The Action for Healthy Kids Organization stated that it is the obligation of the school district to prepare students for a good quality of life through a curriculum that reflects those goals, and that nutrition education should be an integral part of that curriculum. The school district should be vigilant to ensure every student the opportunity to succeed through whatever means necessary. Since researchers indicated a connection between nutrition and learning, the obesity problem is one indication of the lack of nutrition knowledge. The school district can take a more proactive role by providing a broader range of course offerings.

Researchers have focused on the Common Core State Standards in which literacy is viewed as evolving in every grade and subject through fluency and comprehension (Sparks, 2012). Sparks cited Heller and Greenleaf (2007) who argued that there is a need to improve the millions of 4^{th} to 12^{th} graders who struggle to read and write and, therefore, fail to achieve academic success. Although 4^{th} graders have improved in these areas through attention to the problem and the infusion of resources, the Nation's Report Card shows that 2/3rds of the 8-12^{th} graders read at significantly less than proficient level with half scoring below basic level.

Gerewetz (2012) made several statements concerning the core standards. Literacy instruction and comprehension does not fall on the language arts teacher, but is taught in all disciplines and informational text should be incorporated into students' readings because it is critical in building skills for higher education and better jobs. Robelen (2012) stated that the core standards, adopted by all but four states, emphasize teaching literacy across the curriculum and involves all teachers. The English/Language Arts standards Robelen explained, "specifically highlight the teaching of reading, writing, and other literacy objectives in science, history/social studies, and technical subjects" (p.3).

A report from the Secretary's Commission on Achieving Necessary Skills (SCANS) published by the Department of Labor in 1992 identified essential workplace competencies and foundation skills for work, school and after school success and was used as the guide (Mosenson & Fox, 2011, p. 63). The State of New Jersey adopted new standards and revised them in 2009. Emphasis was placed on integrating 21st Century Skills & Global Perspectives and Standard 9 (21st Century Life & Careers) was expanded to include Career and Technical Education listed as 9.4. These life skills include creativity, critical thinking, collaboration, and problem solving skills identified for individuals to function as global citizens and as workers in today's diverse world. Each of the 16 Career Strands contain strand-level content statements and cumulative progress indicators that are essesntial to success in all 16 clusters and pathways (from N.J.A.C. 8A;8- Standards & Assessment). The Partnership for 21st Century skills defined a framework for teaching and learning which integrates these skills into the curriculum and core subjects. The 21st Century Skills provide the foundation. The student outcomes and

five themes are supported by Family and Consumer Sciences programs, including Food and Nutrition courses (Mosenson & Fox, 2011). The skills model and assessment can be found in the appendix.

Although faced with many issues such as overcrowding and financial restraints, districts can examine existing courses for expansion or inclusion of nutrition education. Family and Consumer Sciences classes in the middle and high school can expand the focus on nutrition, and peer interventions for grade school children can be used as an outreach program. Nutrition education can easily fit into the sciences, health, and physical education classes. Gentzler (2012) stated that Family and Consumers Sciences could be the interdiciplinary strategy needed to make a positive difference and is as relevant today as it was 100 years ago. These programs teach applied skills and assist students in making sound decisions (p.7). In addition, districts can offer nutrition classes to parents.

Wolfe et al. (2000) suggested educators should support the school's breakfast and lunch programs; it serves 25 million students lunch and 5 million breakfasts, and children participating in the program consume more key nutrients than those who do not. Educators shold support health and nutrition education in the classroom; well-nourished minds perform better in the school environment (Wolfe et al., 2000). Educators should support daily physical education; children need an active lifestyle, and activity stimulates the learning process (Wolfe et al., 2000). Educators should scrutinize and challenge the claims of special supplements or products. They should check information for accuracy and use proven research (Wolfe et al., 2000). Educators should coordinate efforts

throughout the school and community, creating a network of educators and parents (Wolfe et al., 2000).

Long (2010) focused on wellness programs and partnering with various organizations to nurture healthy habits at school. Activities such as 10-minute physical activity breaks which may include jumping rope or classroom conga lines or fundraisers that have exchanged selling cookie dough for gift wrapping are two examples. Schools have eliminated unhealthy snacks in vending machines. Students have formed fitness clubs and running clubs to motivate couch potatoes to become healthier using a program from Action for Healthy Kids at studentstakingcharge.org. The Alliance for a Healthier Generation suggested educators participate in the Healthy Schools Program which provides free access to resources and tools and can be found at HealthierGeneration.org. The National Education Association's Health Information Network (NEA-HIN) is available for educators through their website (p.28).

Michele Obama's White House Garden began a discussion about the role food plays in healthy living giving way to the Let's Move program (p.29). Educators are offered various opportunities for professional development and districts should encourage either district-wide or out-of-district workshops focused on theory and research, knowledge, teaching strategies, and skills in delivering nutrition information. Each state Dairy Council can provide training and materials.

The federal government offers the School Breakfast Program and the National School Lunch Program to address the issue of hungry children, but there are many other issues that face the success of the programs. The American Dairy Association and Dairy

Council, Inc. (2009) focused not only on the benefits of eating breakfast and its significance in improving academic achievement, but also an increasing participation in the breakfast program in general. They suggested alternative service methods to increase participation. These may include free breakfast to all students regardless of household income to remove any stigma associated with school breakfast, eating breakfast in the classroom or elsewhere on school grounds, implementing time allowance after first period at the middle and high school level for the meal, or Grab "N" Go packaged breakfast bags (p.18). Donovan and Parello (2012) cite The New Jersey Food for Thought School Breakfast Campaign led by Advocates for Children of New Jersey and the New Jersey Anti-Hunger Coalition, driven by a statewide steering committee, which is focused on the goal of boosting participation of the federal School Breakfast Program by 30% targeted for June of 2013. Achieving this goal would increase student participation by 40,000 (p.2).

Donovan and Parello (2012) stated that as child poverty increases in the state and more families struggle financially, more districts recognize the importance of feeding children. Donovan and Parello explained that districts also recognize that academic achievement is linked to healthier kids and discuss the breakfast after the bell program which addresses issues of family and bus schedules which may deter participation (p.3). Districts need to focus on individual alternatives to provide breakfast. Teaching children how to eat healthy should be a joint effort of educators, parents, and school districts.

The governor of New Jersey addressed this issue, and his initiative has focused on school cafeterias. The New Jersey Department of Agriculture's Model School Nutrition

Policy stated that child and adolescent obesity is an epidemic. They attributed this epidemic to poor diet and a lack of exercise, and they determined that it affects the ability to learn. This policy specifically stated what can and cannot be sold in schools and explicit standards with rationale are included in the background for the policy.

Recommendations for Further Study

Given the social issues facing society, information is important. The sources for this information should be reliable and reputable. Caution should be used to insure information is not cluttered by junk science or food industry propaganda. Making a profit has become more important than promoting health. Americans end up paying twice, once for research through tax dollars and again for preventable diseases through health care costs. More convesations are needed in addressing the issues discussed in this study and other related issues.

Any intervention can positively affect the learning capability of students. Every child should be afforded the opportunity to come to school having eaten a nutritionally sound breakfast or given the opportunity to participate in the Federal School Breakfast Program. It is only when children learn to make healthy food choices and fully understand the connection between nutrition and learning that they may be successful learners. This will happen when schools, parents, educators, administrators, boards of education, and community members understand this connection. It is imperative that we give students the resources to become successful members of society because the cost of their failure will be unprecedented.

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Appendix A: Nutrtion Pretest Posttest

Using the words lettered A-E above each group of statements, correctly complete the sentences.

A. additives B. diet C. enriched or restored

D. balanced diet E. body processes

1. Breads and cereals are examples of foods which are _____with specific amounts of vitamins and minerals. This is done because vitamins and minerals were removed during milling and must be returned in order to raise the nutritive value of the food.
2. The meals we eat regularly are referred to as our_____.
3. When foods from all the food groups are included in our meals and together they provide all the nutrients necessary to keep an average person in good health, we would consider ourselves to be following an/a_____.

A. nutrition B. hunger C. additives

D. appetite E. calories

4. _____is the urge to eat.
5. _____is a desire for food.
6. When manufacturers are attempting to prevent or minimize loss of quality, retard spoilage, add nutrients, enhance flavors, or make foods look better _____ intended to do these jobs.

A. nutrients B. balanced diet C. nutrition

D. body processes E. malnutrition

7. Respiration, digestion, and circulation are three different body functions which are not voluntarily controlled and are referred to as_____.

8. An eating plan which meets all the nutritional needs of a person throughout the day is called a/an_____

9. The science of food, its use in the body and its effect on health is called_____.

A. nutrients B. food guide pyramid C. calorie

D. additive E. nutrition

10. Fats, vitamins, minerals, proteins, water, and carbohydrates are defined as_____.

11. Energy value of food is defined as a/an_____.

12. Common foods divided into food groups with a recommended number of servings daily refers to the_____.

A. malnutrition B. junk food C. U.S. R.D.A.

D. food guide E. balanced diet

13. An inadequate intake of nutrients that results in poor health is defined as_____.

14. Foods with little or no nutrient value are referred to as_____.

15. A list of nutrients and their amounts that should be consumed daily as suggested by the government health agencies is referred to as_____.

A. saturated fats B. unsaturated fats C. amino acids

D. carbohydrates E. iron

16. These fats are mainly from animals and are usually high in cholesterol _____.

17. These are chiefly vegetable oils _____.

18. Proteins are made from these units. There are ten essential ones that must be supplied by our food _____.

A. incomplete protein B. vitamin C C. water

D. vitamin D E. iron

19. Oranges, lemons, grapefruits, and limes are major sources _____.

20. Approximately 2/3 of the body is made of this nutrient _____.

21. This vitamin is absorbed through the skin when it is exposed to direct sunlight _____.

A. incomplete protein B. carbohydrate C. iron

D. fat soluble E. water soluble

22. Food supplies this nutrient in three forms; sugars, starches, and cellulose _____.

23. Lack of one or more of the essential amino acids _____.

24. A deficiency of this nutrient is called anemia and produces fatigue and low resistance to disease _____.

25. Vitamins which cannot be stored by the body to any significant extent and must be replaced daily.

Appendix B: Foods I Nutrition Intervention

Nutrition Education Survey

This survey is designed for the purpose of investigating any changes that may be needed to improve the nutrition education component of the Foods I class.
Thank you for your participation.

1. Nutrition education should be taught in school

	Agree	**Somewhat Agree**	**Somewhat Disagree**	**Disagree**
Select one of the following:				

2. Nutrition education should be taught well before the high school years.

	Agree	**Somewhat Agree**	**Somewhat Disagree**	**Disagree**
Select one of the following:				

3. This nutrition component was easy for me to understand.

	Agree	**Somewhat Agree**	**Somewhat Disagree**	**Disagree**
Select one of the following:				

4. I am more aware of how important good nutrition practices are to my health

	Agree	**Somewhat Agree**	**Somewhat Disagree**	**Disagree**
Select one of the following:				

5. I feel I received important information on nutrition that I could use every day

	Agree	**Somewhat Agree**	**Somewhat Disagree**	**Disagree**
Select one of the following:				

6. I try to eat breakfast every day

	Agree	**Somewhat Agree**	**Somewhat Disagree**	**Disagree**
Select one of the following:				

7. I choose nutrient dense foods for breakfast

	Agree	Somewhat Agree	Somewhat Disagree	Disagree
Select one of the following:				

8. I try to pick foods from all the nutrient groups daily.

	Agree	Somewhat Agree	Somewhat Disagree	Disagree
Select one of the following:				

9. I try to eat three balanced meals every day.

	Agree	Somewhat Agree	Somewhat Disagree	Disagree
Select one of the following:				

10. I keep my sugar level even all day by eating nutritious snacks.

	Agree	Somewhat Agree	Somewhat Disagree	Disagree
Select one of the following:				

Part 2

1. Nutrition Education Survey - part 2

This survey is designed for the purpose of investigating any changes that may be needed to improve the nutrition education component of the Foods I class.
Thank you for your participation.

1. I try to control my intake of sugar by drinking less sugary beverages

	Always	Almost Always	Sometimes	Almost Never	Never
Select one of the following:					

2. I try to have the equivalent of 8 glasses of water per day in my diet.

	Always	Almost Always	Sometimes	Almost Never	Never
Select one of the following:					

3. I read package labels.

	Always	**Almost Always**	**Sometimes**	**Almost Never**	**Never**
Select one of the following:					

4. I read the ingredient panel to determine what the food contains.

	Always	**Almost Always**	**Sometimes**	**Almost Never**	**Never**
Select one of the following:					

5. I make better food choices because I feel I understand labels and how to read them.

	Always	**Almost Always**	**Sometimes**	**Almost Never**	**Never**
Select one of the following:					

Appendix C: Child Nutrition Fact Sheet

1. Missing breakfast and experiencing hunger impair children's ability to learn.
    - Children who skip breakfast are less able to distinguish among similar images, show increased errors, and have slower memory recall.
    - Children experiencing hunger have lower math scores and are more likely to have to repeat a grade.
    - Behavioral, emotional and academic problems are more prevalent among children with hunger.
    - Children who are undernourished score lower on cognitive tests when they miss breakfast.
    - Teens experiencing hunger are more likely to have been suspended from school, have difficulty getting along with other children, and have no friends.
    - Children with hunger are more likely to have repeated a grade, received special education services, or received mental health counseling, than low-income children who do not experience hunger.
2. Eating breakfast at school helps children perform better.
    - Children who eat a complete breakfast, versus a partial one, make fewer mistakes and work faster in math and number checking tests.
    - Children who eat breakfast at school-closer to class and test-taking time-perform better on standardized tests than those who skip breakfast or eat breakfast at home.

- Providing breakfast to mildly undernourished students at school improves their speed and memory in cognitive tests.
- Participating in school breakfast is associated with improved math grades, attendance and punctuality.
- Children perform better on tests of vocabulary and matching figures after eating breakfast.
- Consuming breakfast improves children's performance on demanding mental tasks and reaction to frustration.

3. School breakfast improves student behavior and learning environments.
    - Schools that provide breakfast in the classroom to all students show decreases in tardiness and suspensions as well as improved student behavior and attentiveness.
    - Providing students with breakfast in the classroom setting is associated with lower tardy rates and fewer disciplinary office referrals.
    - School breakfast programs can lower absence and tardiness rates and improve stantardized achievement test scores.
4. Universal school breakfast programs yield positive results.
    - Children who participate in universal school breakfast have lower rates of absence and tardiness.
    - Schools that provide universal school breakfast have higher breakfast participation, especially when breakfast is served in the classroom, and

students who significantly increase their breakfast participation are more frequently on time and in attendance.

- Schools providing all students with free breakfast have greater positive changes in academic performance.

5. Breakfast can improve children's diets.

- Children who eat breakfast tend to have more adequate nutrient intakes than children who do not.
- By eating breakfast, students also get more of important nutrients, vitamins and minirals such as calcium, dietary fiber, folate and protein.
- A higher percentage of children who skip breakfast do not meet two-thirds of the Recommended Dietary Allowance (RDA) for vitamins A,E,D, and B6.

6. Breakfast may reduce obesity risk.

- Adolescents who eat breakfast tend to have a lower body mass index (BMI); higher BMIs can indicate overweight and obesity.
- Girls who eat breakfast are more likely to have a lower BMI than girls who skip breakfast.
- Adolescents with one or two obese parents who eat breakfast every day are more likely to have BMIs within a healthy range than those who tend to skip breakfast.

- Low-income elementary school girls who participate in the School Breakfast, School Lunch or Food Stamp Programs, or any combination of these programs, have significantly less risk of being overweight.

7. Beliefs about breakfast can influence participation.
    - Girls often skip breakfast because they believe it might make them fat and are concerned about gaining weight.
    - Adolescents who skip breakfast are significantly more likely to have fasted to lose weight.
    - Children report that they believe eating breakfast increases their energy and ability to pay attention in school.

Appendix D: Lesson Plan Template

WEEK OF : October 5, 2009 Foods A #6A	NJCCS/CPIs: 14.1 14.2 14.3 14.5 9.1 9.2 9.6	ESSENTIAL QUESTION(s): Describe the parts of a recipe, define terms used. Measure ingredients accurately	RESOURCES: Adventures in Food and Nutrition	
MON	**TUES**	**WED**	**THURS**	**FRI**
Objectives: students will understand class rules, lab set-up and kitchen procedures during lab	Obj.: students will prepare individual breakfast pizza as an alternative breakfast food in lab	Obj.: students will describe the parts of a recipe and the terms associated with reading a recipe	Obj.: students will prepare individual breakfast cheese sandwhich as an alternative breakfast food in lab	Obj.: students will understand how to measure dry & liquid ingredients for lab. They will distinguish between the different types of equipment needed to measure successfully.
Vocabulary Introduced Color coded kitchens Kitchen jobs	Vocabulary Introduced Alternative breakfast	Vocabulary Introduced Recipe yield	Vocabulary Introduced	Vocabulary Introduced Abbreviation Recipe shorthand Weights Volume Liquid ingredients equivalents
Anticipatory Set: Is a sharp knife or a dull Knife safer to use in the kitchen and why?	Anticipatory Set:	Anticipatory Set: What is the safest way to clean up broken glass in the kitchen?	Anticipatory Set:	Anticipatory Set: How do you open a lid of a cooking pot and why?
Steps to the Lesson: 1.discussion of class conduct and procedures 2. explanation of how kitchen works 3. explain assigned kitchen jobs-assign lab jobs for class tomorrow 4. discussion of lab procedures	Steps to the Lesson: 1.distribute ingredients and equipment 2.follow recipe directions for preparation of ingredients 3.follow time schedule 4. bake 5. sample and evaluate 6. proper clean up in time allotted	Steps to the Lesson: 1.introduce Ch 10 Recipes 2.discussion of pg 186 parts of the recipe 3.define terms notebook 4. Wksht Activity A – A Recipe: The Sum of It's Parts 5.Wksht Putting A Recipe in Order	Steps to the Lesson: 1.distribute ingredients and equipment 2.follow recipe directions for preparation of ingredients 3.follow time schedule 4. bake 5. sample and evaluate 6. proper clean up in time allotted	Steps to the Lesson: 1. introduce new terms 2.introduce measuring equipment-trace sizes notebook 3.List steps for measuring dry and liquid ingredients in notebook

Writing Activity **Copy kitchen jobs notebook**	**lab**	**Notebook worksheets**	**lab**	**Notebook**
Recipe and Food Group (For Consumer Science Teachers Only) **Breakfast Alternatives**	**Grains, fruit, dairy**		**Grains, fruit, dairy**	
Technology Integration: **posters**	**Technology Integration:** **lab**	**Technology Integration:** **Overhead projector**	**Technology Integration:** **lab**	**Technology Integration:**
Lesson Closure: **Describe your assigned job for lab tomorrow and your duties.**	**Lesson Closure:** **Is this a breakfast alternative you would prepare at home?**	**Lesson Closure:** **What are the basic parts of a recipe?**	**Lesson Closure:**	**Lesson Closure: What is the major difference between measuring dry & liquid measures?**
Assign- **List homework or other projects in this box.**		**Exam a recipe you find at home and look for the basic parts.**		
Assessment: Teacher observation Student oral participation	**Assessment: Teacher observation Cooperative learning groups Lab observation**	**Assessment: Teacher observation Student written participation Oral participation Notebook**	**Assessment: Teacher observation Cooperative learning groups Lab observation**	**Assessment:** **Teacher observation Student written participation Oral participation**
Teacher Reflection:	**Teacher Reflection:**	**Teacher Reflection:**	**Teacher Reflection:**	**Teacher Reflection:**
Mods./ Accomodations: IEP/504/ ELL/ I&RS **SJ- extra time-praise-encouragement-study guide-repeat-clarify** **KM- cooperative learning-praise-consistency-smaller components-repeat**				

Connections to other Core Content Areas 1. Mathematics 4.2 4.3 4.5 2. Science 5.1 5.2 5.3 5.4 5.10 3. Social Studies 4. World Language 5. Language Arts 3.1 3.2 3.3 3.4

LESSON PLAN TEMPLATE

Lydia Singura

B = Beginner I = Intermediate A = Advanced

Appendix E: New Jersey Model School Nutrition Policy

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NEW JERSEY MODEL SCHOOL NUTRITION POLICY

PROVIDING HEALTHY CHOICES FOR ALL STUDENTS

Helping children establish healthy eating habits to last a lifetime

THE POLICY

"NOTHING BUT THE FACTS"

The Board of Education recognizes that child and adolescent obesity has reached epidemic levels in the United States and that poor diet combined with lack of physical activity negatively impacts on students' health and ability and motivation to learn. The Board is therefore committed to:

- Providing healthy and nutritious food
- Encouraging the consumption of fresh fruits/vegetables, low fat milk and whole grains
- Supporting nutrition education
- Encouraging students to consume all components of the school meal
- Providing students with daily physical activity

A winning combination: Nutritious meals and physical activity!

The following items may not be served, sold or given out as free promotion anywhere on school property at anytime before the end of the school day:

- Foods of minimal nutritional value (FMNV), as defined by USDA regulations
- All food and beverages listing sugar, in any form, as the first ingredient
- All forms of candy

Beverage and Snack Standards

All Schools

All snacks and beverage items sold or served on school property during the school day, shall meet the following standards:

- Based on nutrient fact labels:
  - No more than eight grams of total fat per serving, with the exception of nuts and seeds
  - No more than two grams of saturated fat per serving
- All beverages shall not exceed 12 ounces, with the following exceptions:
  - Water
  - Milk containing two per cent or less fat
- Whole milk should not exceed eight ounces

Elementary Schools

- 100 percent of all beverages offered shall be milk, water or 100 percent fruit or vegetable juices

Middle and High Schools

- At least 60 percent of all beverages offered, other than milk and water, shall be 100 percent fruit or vegetable juices
- No more than 40 percent of all ice cream/frozen desserts shall be allowed to exceed the above standards for sugar, fat, and saturated fat

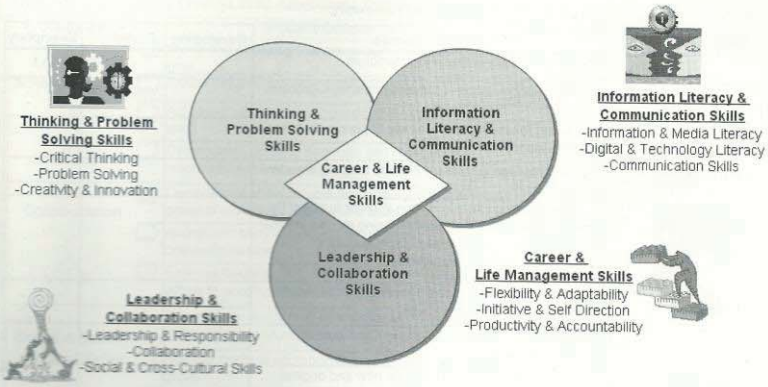


Figure 1. 21st Century Process Skills Model.

included in this area: information and media literacy, digital and technology literacy, and communication skills.

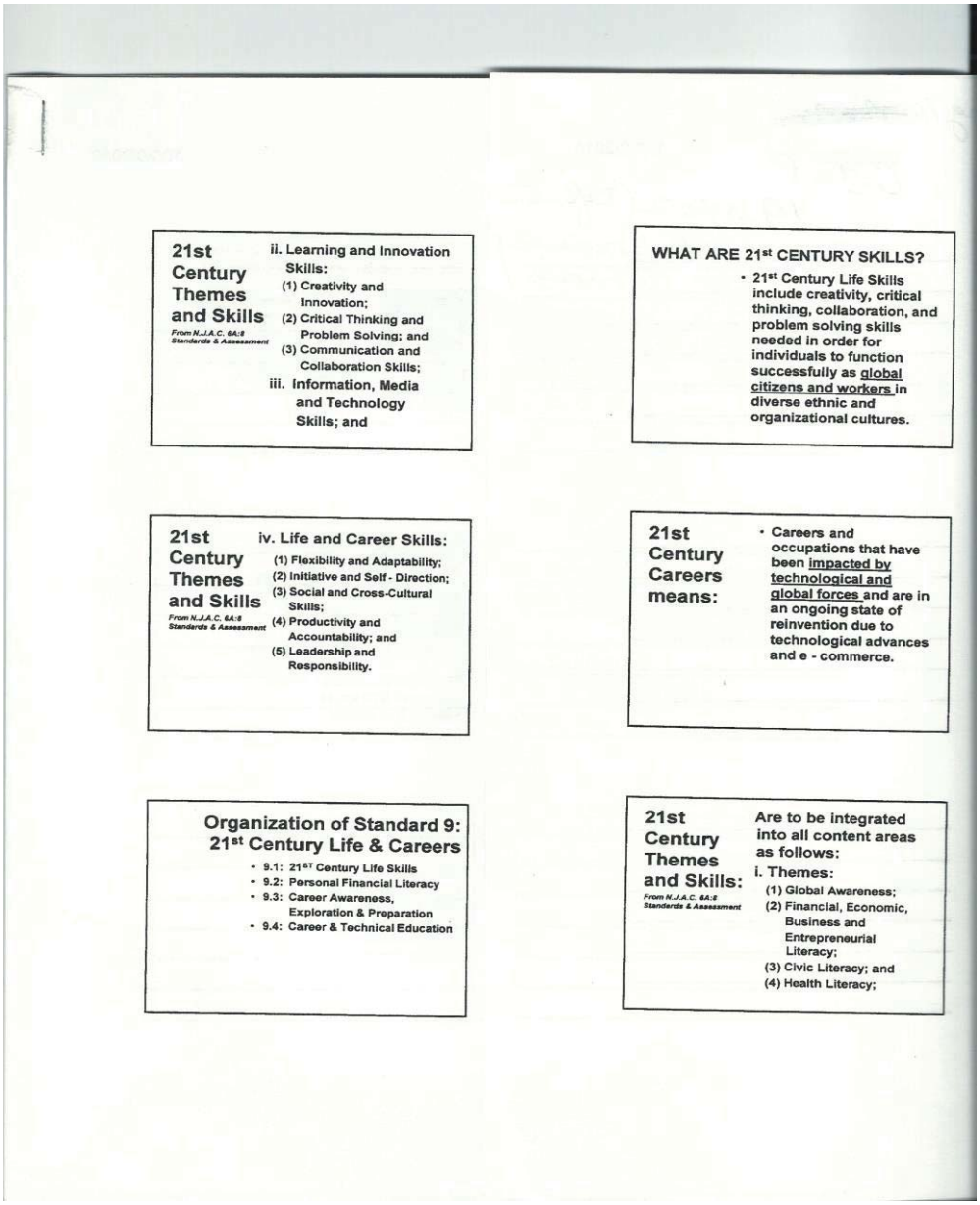
- *Leadership and collaboration skills:* Good leaders relate well to others by motivating them to work together to accomplish a shared goal. Leaders are able to build and sustain human relationships that enable people to take action and achieve a stated purpose (Kouzes & Posner, 2007). This skill area encompasses leadership and responsibility, collaboration, and social and cross-cultural skills.
- *Career and life management skills:* These skills, often called "soft or applied" skills, are emerging as key components of an individual's overall education (Bancino & Zevalkink, 2007). Such skills are necessary for individuals to become responsible citizens and productive workers given that adapting to change and transferring knowledge and skills to new situations will be the norm rather than the exception. In the model, these skills are integrated and taught with the other skills to provide an in-depth understanding of an ever-changing world. This area includes flexibility and adaptability, initiative and self-direction, and productivity and accountability.

21st Century Process Skills Assessment Framework

The 21st Century Process Skills Assessment Framework (see Table 1) is a tool to help monitor and evaluate student learning of process skills. It can be used for formative and summative assessments by both teachers and students. In the case of formative assessments, the framework can provide information about students' current performance and areas in which additional development is needed. As a tool for summative assessments, the framework provides documentation of students' level of performance on the outcomes identified.

In the assessment framework, several student outcomes are listed for each component. When the framework is used for either formative or summative assessments, the outcomes that apply to a particular performance task should be identified and a check mark placed in the box beside the selected outcomes. After the task or project has been completed, teachers can assess students' work, and students can assess their own work, by designating the level of performance attained on each selected outcome. Three levels of performance are identified in the framework: developing, proficient, and exemplary.

Appendix F: 21st Century Process Skills Model



21st Century Themes and Skills
From N.J.A.C. 6A:8 Standards & Assessment

ii. Learning and Innovation Skills:
(1) Creativity and Innovation;
(2) Critical Thinking and Problem Solving; and
(3) Communication and Collaboration Skills;
iii. Information, Media and Technology Skills; and

WHAT ARE 21st CENTURY SKILLS?

- 21st Century Life Skills include creativity, critical thinking, collaboration, and problem solving skills needed in order for individuals to function successfully as global citizens and workers in diverse ethnic and organizational cultures.

21st Century Themes and Skills
From N.J.A.C. 6A:8 Standards & Assessment

iv. Life and Career Skills:
(1) Flexibility and Adaptability;
(2) Initiative and Self - Direction;
(3) Social and Cross-Cultural Skills;
(4) Productivity and Accountability; and
(5) Leadership and Responsibility.

21st Century Careers means:

- Careers and occupations that have been impacted by technological and global forces and are in an ongoing state of reinvention due to technological advances and e - commerce.

Organization of Standard 9: 21st Century Life & Careers

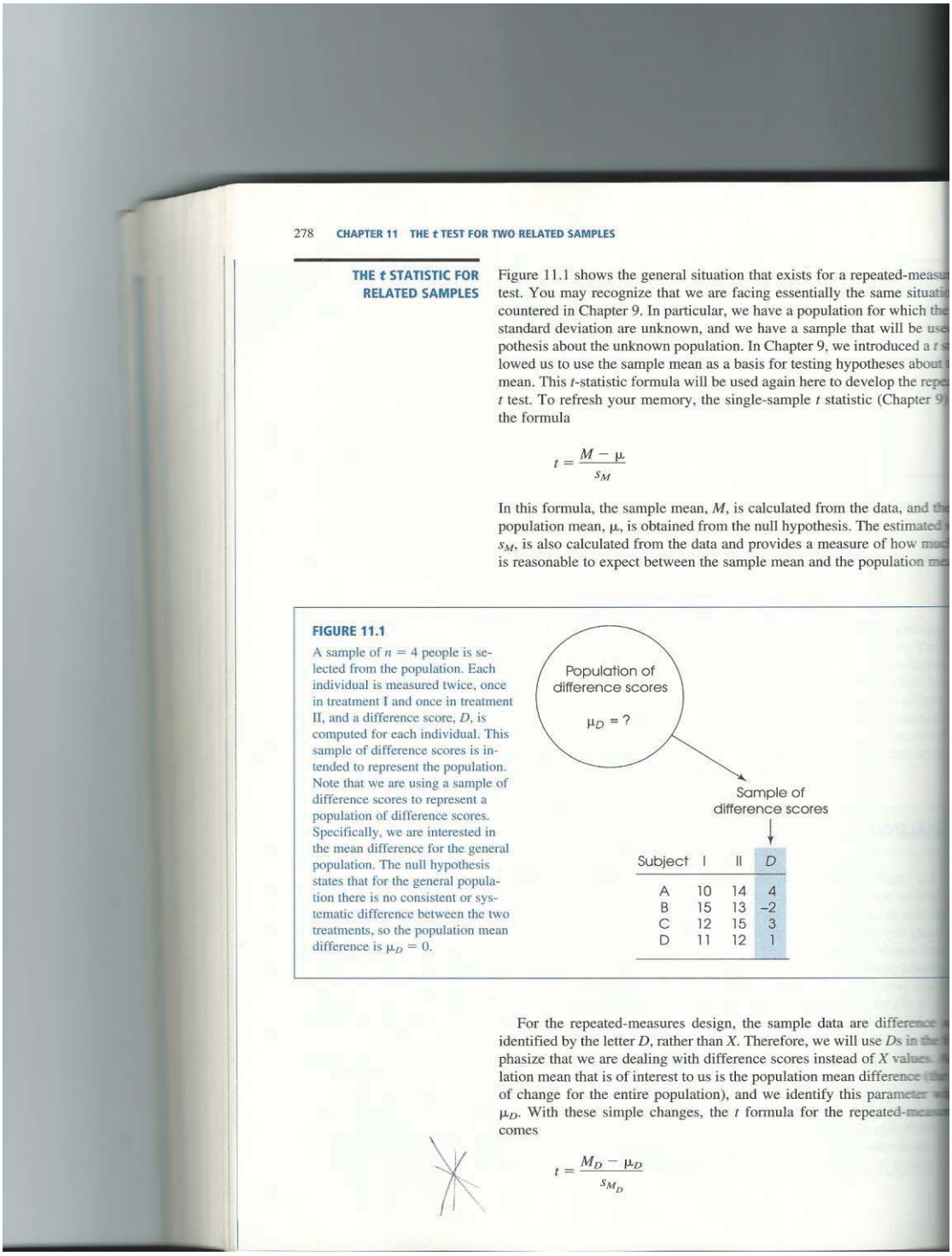
- 9.1: 21ST Century Life Skills
- 9.2: Personal Financial Literacy
- 9.3: Career Awareness, Exploration & Preparation
- 9.4: Career & Technical Education

21st Century Themes and Skills:
From N.J.A.C. 6A:8 Standards & Assessment

Are to be integrated into all content areas as follows:
i. Themes:
(1) Global Awareness;
(2) Financial, Economic, Business and Entrepreneurial Literacy;
(3) Civic Literacy; and
(4) Health Literacy;

Appendix G: Balanced Approach

Appendix H: How Much Do You Eat



278 CHAPTER 11 THE t TEST FOR TWO RELATED SAMPLES

THE t STATISTIC FOR RELATED SAMPLES

Figure 11.1 shows the general situation that exists for a repeated-measu test. You may recognize that we are facing essentially the same situati countered in Chapter 9. In particular, we have a population for which the standard deviation are unknown, and we have a sample that will be use pothesis about the unknown population. In Chapter 9, we introduced a *t* s lowed us to use the sample mean as a basis for testing hypotheses about mean. This *t*-statistic formula will be used again here to develop the repe *t* test. To refresh your memory, the single-sample *t* statistic (Chapter 9 the formula

$$t = \frac{M - \mu}{s_M}$$

In this formula, the sample mean, M, is calculated from the data, and th population mean, μ, is obtained from the null hypothesis. The estimated s_M, is also calculated from the data and provides a measure of how muc is reasonable to expect between the sample mean and the population me

FIGURE 11.1

A sample of $n = 4$ people is selected from the population. Each individual is measured twice, once in treatment I and once in treatment II, and a difference score, D, is computed for each individual. This sample of difference scores is intended to represent the population. Note that we are using a sample of difference scores to represent a population of difference scores. Specifically, we are interested in the mean difference for the general population. The null hypothesis states that for the general population there is no consistent or systematic difference between the two treatments, so the population mean difference is $\mu_D = 0$.

Subject	I	II	D
A	10	14	4
B	15	13	−2
C	12	15	3
D	11	12	1

For the repeated-measures design, the sample data are difference identified by the letter D, rather than X. Therefore, we will use Ds in the phasize that we are dealing with difference scores instead of X values. lation mean that is of interest to us is the population mean difference of change for the entire population), and we identify this parameter μ_D. With these simple changes, the t formula for the repeated-measu comes

$$t = \frac{M_D - \mu_D}{s_{M_D}}$$

Appendix I: Sample Brain Meal

Here's a sample meal plan that keeps your brain in gear all day; for a printable copy of this chart visit this book's "Missing CD" page at *www.missingmanuals.com*.

Meal	Recommended Food	Example
Breakfast	A modest helping of complex carbohydrates with a dash of protein.	Oatmeal and yogurt (of the low-fat, low-sugar variety) A fried egg with whole wheat toast
Late Morning Snack	More complex carbohydrates. This is an ideal time to get those fruit and veggie servings in.	Fruit salad Carrot sticks
Lunch	Protein and complex carbohydrates.	A tuna sandwich with salad Salmon and squash over brown rice
Afternoon Snack	Another helping of complex carbohydrates, with extra points for fruit and veggies.	Tomato salad Strawberries and cashews
Dinner	Complex carbohydrates with protein and a dash more fat to get you through the night.	Roasted chicken and sweet potato Seafood paella
Evening Snack	A very small amount of sugar and fat helps put the brain to sleep. But be warned—dessert is a rocky coast that dashes many good intentions!	Dark chocolate Tea and a cupcake

School breakfast improves student behavior and learning environments

- Schools that provide breakfast in the classroom to all students show decreases in tardiness and suspensions as well as improved student behavior and attentiveness.[20, 21]
- Providing students with breakfast in the classroom setting is associated with lower tardy rates and fewer disciplinary office referrals.[22]
- School breakfast programs can lower absence and tardiness rates and improve standardized achievement test scores.[23]

Universal school breakfast programs yield positive results

- Children who participate in universal school breakfast have lower rates of absence and tardiness.[24, 25]
- Schools that provide universal school breakfast have higher breakfast participation, especially when breakfast is served in the classroom, and students who significantly increase their breakfast participation are more frequently on time and in attendance.[26]
- Schools providing all students with free breakfast have greater positive changes in academic performance.[27]

Breakfast can improve children's diets

- Children who eat breakfast tend to have more adequate nutrient intakes than children who do not.[28]
- By eating breakfast, students also get more of important nutrients, vitamins and minerals such as calcium, dietary fiber, folate and protein.[29,30]
- A higher percentage of children who skip breakfast do not meet two-thirds of the Recommended Dietary Allowance (RDA) for vitamins A, E, D, and B_6.[31]

Breakfast may reduce obesity risk

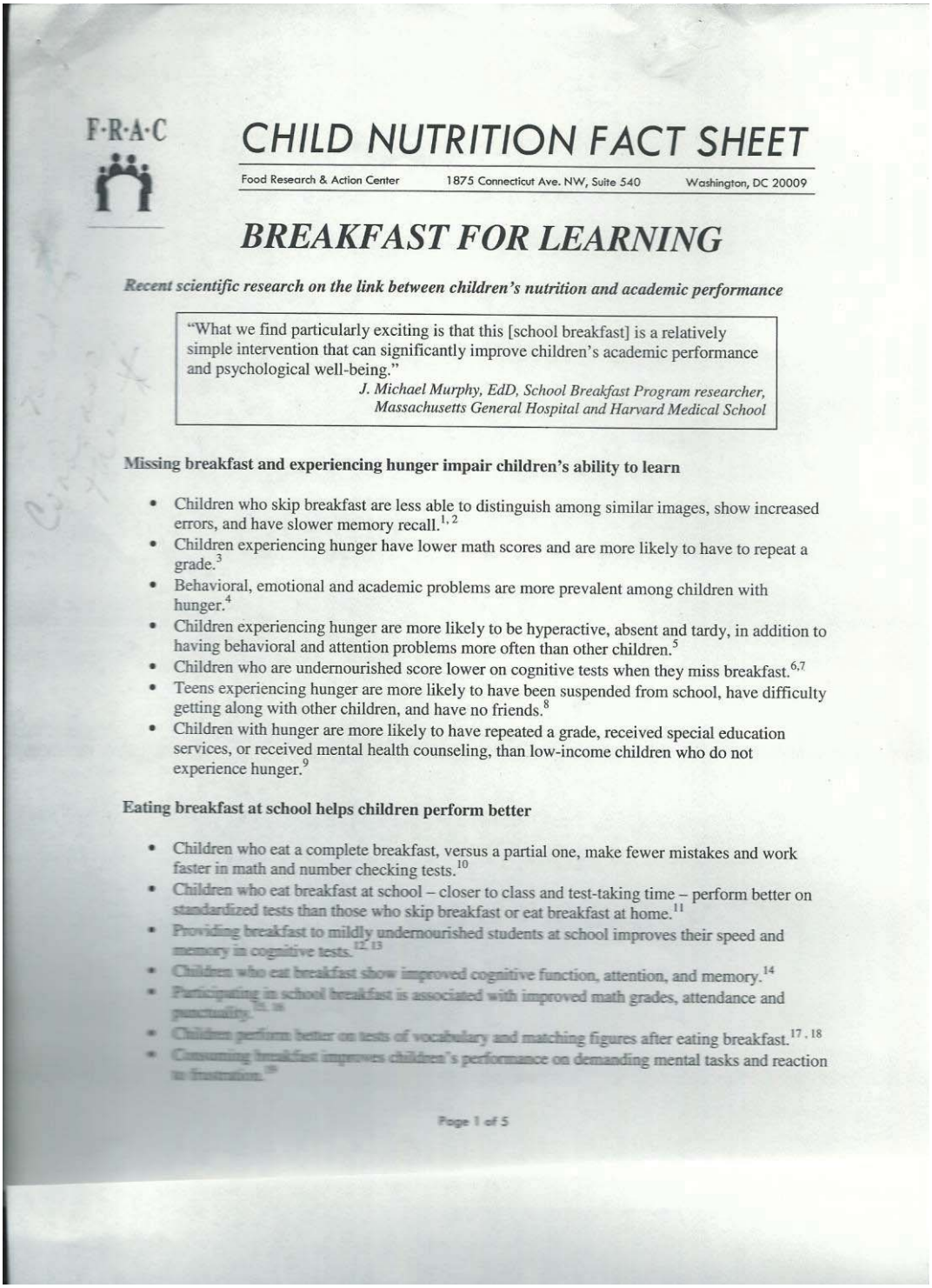
- Adolescents who eat breakfast tend to have a lower body mass index (BMI); higher BMIs can indicate overweight and obesity.[32]
- Girls who eat breakfast are more likely to have a lower BMI than girls who skip breakfast.[33]
- Adolescents with one or two obese parents who eat breakfast every day are more likely to have BMIs within a healthy range than those who tend to skip breakfast.[34]
- Low-income elementary school girls who participate in the School Breakfast, School Lunch, or Food Stamp Programs, or any combination of these programs, have significantly less risk of being overweight.[35]

Beliefs about breakfast can influence participation

- Girls often skip breakfast because they believe it might make them fat and are concerned about gaining weight.[36, 37]
- Adolescents who skip breakfast are significantly more likely to have fasted to lose weight.[38]
- Children report that they believe eating breakfast increases their energy and ability to pay attention in school.[39]

FOOD RESEARCH & ACTION CENTER (FRAC)
1875 Connecticut Ave., NW, Suite 540 • Washington, DC 20009
TEL (202) 986-2200 • FAX (202) 986-2525 • foodresearch@frac.org • www.frac.org

Appendix J: F-R-A-C Child Nutrition Fact Sheet



F·R·A·C

CHILD NUTRITION FACT SHEET

Food Research & Action Center 1875 Connecticut Ave. NW, Suite 540 Washington, DC 20009

BREAKFAST FOR LEARNING

Recent scientific research on the link between children's nutrition and academic performance

> "What we find particularly exciting is that this [school breakfast] is a relatively simple intervention that can significantly improve children's academic performance and psychological well-being."
>
> *J. Michael Murphy, EdD, School Breakfast Program researcher, Massachusetts General Hospital and Harvard Medical School*

Missing breakfast and experiencing hunger impair children's ability to learn

- Children who skip breakfast are less able to distinguish among similar images, show increased errors, and have slower memory recall.[1, 2]
- Children experiencing hunger have lower math scores and are more likely to have to repeat a grade.[3]
- Behavioral, emotional and academic problems are more prevalent among children with hunger.[4]
- Children experiencing hunger are more likely to be hyperactive, absent and tardy, in addition to having behavioral and attention problems more often than other children.[5]
- Children who are undernourished score lower on cognitive tests when they miss breakfast.[6,7]
- Teens experiencing hunger are more likely to have been suspended from school, have difficulty getting along with other children, and have no friends.[8]
- Children with hunger are more likely to have repeated a grade, received special education services, or received mental health counseling, than low-income children who do not experience hunger.[9]

Eating breakfast at school helps children perform better

- Children who eat a complete breakfast, versus a partial one, make fewer mistakes and work faster in math and number checking tests.[10]
- Children who eat breakfast at school – closer to class and test-taking time – perform better on standardized tests than those who skip breakfast or eat breakfast at home.[11]
- Providing breakfast to mildly undernourished students at school improves their speed and memory in cognitive tests.[12, 13]
- Children who eat breakfast show improved cognitive function, attention, and memory.[14]
- Participating in school breakfast is associated with improved math grades, attendance and punctuality.[15, 16]
- Children perform better on tests of vocabulary and matching figures after eating breakfast.[17, 18]
- Consuming breakfast improves children's performance on demanding mental tasks and reaction to frustration.[19]

Curriculum Vitae

Lydia Singura

food4thought@comcast.net

Education:

Master of Arts-Early Childhood Education
1995
Kean University, Union, New Jersey

Bachelor of Science-Home Economics Education
1968
James Madison University, Harrisonburg, Virginia

Relevant Professional Experience:

Teacher
1983-2010
Carteret School District, Carteret, New Jersey
Classroom teacher at Carteret High School's Family and Consumer Sciences (formerly known as Home Economics) Department

Substitute teacher
1980-83
Classroom substitute teacher K-8

Teacher
1968-70
St. Elias Parochial School, Carteret, New Jersey
Classroom teacher grades 5 and six, Science grades 7 and 8

Community Service:

Vice-President, Carteret Board of Education
2012-Present

Member, Carteret Board of Education
2010-2012

Certifications:

Elementary School Teacher
1996
State of New Jersey

Supervisor
2000
State of New Jersey

Honors and Awards:

Carteret High School Teacher of the Year
1993

Carteret District Teacher of the Year
1993

A+ For Kids Teacher Network Disseminator Grant Award
1993

Who's Who Among America's Teachers
1996

Family, Career and Community Leaders of America Master Advisor
2000

The Karen Opeyoke Outstanding Advisor Award
2003

Who's Who Among America's Teachers
2003-04

Professional Affiliations;

Member, Nation Education Association
Member, New Jersey Education Association
County Representative 1999-01, Middlesex County Education Association
Member, Association of Family and Consumer Sciences

Treasurer-elect 1992-93, 2012-12, Treasurer 1993-94, 2013-present, New Jersey Family and Consumer Sciences
President, 1990-98, Middlesex County Family and Consumer Sciences
Corresponding Secretary 1992-93, Educators of Family and Consumer Sciences
Member, Kappa Delta Phi