

THESIS

WELLNESS INTEGRATED MATHEMATICS

Submitted by

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ABSTRACT

WELLNESS INTEGRATED MATHEMATICS

Wellness Integrated Mathematics (WIM) was a four-week, 8th grade mathematics curriculum that taught proportional reasoning using nutrition and fitness examples. The three objectives were to increase student knowledge of nutrition, fitness and math.

WIM used a quasi-experimental, non-randomized, control/comparison design. Participants were four eighth-grade math classes in a single middle school. Two classes, totaling 47 students, were assigned to the comparison group. Two classes, totaling 48 students, were assigned to the intervention group.

WIM was modeled after the successful middle school nutrition intervention, EatFit. The four-week curriculum consisted of nine lessons including a food demonstration and food tastings.

To measure change in nutritional and fitness knowledge, the previously tested 21-item Wellness Integrated Mathematics Questionnaire (WIM-Q) was given to both groups before and after the intervention. Mathematical knowledge was measured by giving the Ratios and Proportions Math Exam to both groups before and after the intervention. Paired samples t-tests were performed on data from pre- and post-tests for both groups.

The intervention group showed significant increases in overall (pre-test/post-test) percentage scores for: nutritional knowledge (60%/76%), $p = .000$; fitness knowledge (65%/80%), $p = .000$; and math knowledge (39%/92%), $p = .000$. The comparison group made only significant increases in math knowledge (22%/90%), $p = .000$.

Results of the Wellness Integrated Mathematics Intervention indicate that a standards-based mathematics curriculum integrating nutrition and fitness can be an effective way to teach proportional reasoning while increasing nutrition and fitness knowledge.

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CHAPTER 1

INTRODUCTION

Project Rationale

There is an obesity epidemic in this country. The prevalence of obesity is increasing more rapidly in children than in adults (Macera, 2010). Unfortunately, children today are not eating enough fruits or vegetables (Gleason, 2001), nor are they getting enough exercise (Duke, 2003). In addition, obese children are more likely to grow up to be obese adults than their non-obese counterparts (Guo, 1999). Disease risks increase substantially with increased body mass index (Thompson, 1999).

Education is a first step to reversing this trend. Ensuring that nutrition is taught in schools may involve innovative, nontraditional means of incorporating nutrition into the school curriculum (Probart, 1997). Although art, foreign language, and physical activity classes sometimes get cut due to financial strains on school districts, reading, writing, and mathematics are three subjects that will not be eliminated. Integrating nutrition and physical activity into these core classes would be a win-win situation for both schools and students.

Nutrition education and physical activity education can be integrated into the middle school mathematics curriculum. Both of these non-core subjects could accommodate extensive problem solving and numerical calculations. Education experts believe that real-life, practical examples related to students' lives motivate them to learn

(Seeley, 2004). By utilizing nutrition and physical activity examples relevant to each student's own life and interests, the curriculum itself becomes an inspiration for students to gain understanding and become life-long learners.

Using School-Based Core-Subject Interventions to Reduce Childhood Obesity

There are many successful school-based programs that integrate nutrition and fitness into the core subjects of math, science, language arts, and social studies.

(Fahlman, 2008; Contento, 2007; Gortmaker, 1999). Many report success in increasing nutrition and/or fitness knowledge and several have been successful at positively changing behavior. The question that still remains is: How does the integration of nutrition and fitness into a core subject, such as mathematics, science, or social studies, effect knowledge acquisition of that core subject?

Objectives of the Wellness Integrated Mathematics Intervention

Wellness Integrated Mathematics (WIM) is a 4-week math unit teaching proportional reasoning using nutrition and fitness examples. WIM aimed at providing students knowledge about nutrition and fitness while successfully teaching required mathematical concepts. The three main objectives of the WIM intervention were to:

- Increase nutrition knowledge.
- Increase fitness knowledge.
- Increase mathematical knowledge as well as a traditional proportional reasoning mathematics unit can.

This study assessed the effectiveness of the WIM intervention on nutrition, fitness, and math knowledge acquisition.

CHAPTER 2

REVIEW OF THE LITERATURE

Prevalence of Childhood Obesity

Overweight and obesity, especially among children, have emerged as serious threats to our nation's health (Troiano, 1995). According to the Centers for Disease Control (CDC), a child is overweight if the child has a BMI at or above the 85th percentile and lower than the 95th percentile. A child is obese if the child has a BMI at or above the 95th percentile for children of the same age and sex. (BMI is calculated differently for children than it is for adults. For children and adolescents aged 2–19 years, the BMI value is plotted on the CDC growth charts to determine the corresponding BMI-for-age percentile.) Prevalence of obesity is increasing more rapidly in children than in adults (Macera, 2010). Over the last two decades, rates of obesity have doubled in children and tripled in adolescents. One in seven young people is obese, and one in three is overweight (Ogden, 2002).

Causes of Childhood Obesity

Both genes and environment contribute to obesity risk (Barlow, 2007). At a population level, the increase in prevalence is too rapid to be explained by a genetic shift; rather, it must result in changes in eating and physical activity behaviors that have shifted the balance of energy intake and energy expenditure (Barlow, 2007). Scientific research increasingly confirms that what we eat may have a significant impact on our health, quality of life, and longevity. In one study, the risk of cardiovascular disease was

decreased by 4% for each serving per day of fruit or vegetable (Dauchet, 1996). In the U.S., high intakes of fat and saturated fat, and low intakes of calcium and fiber-containing foods such as whole grains, vegetables, and fruits, are associated with several chronic health conditions that can impair the quality of life and hasten mortality (Ness, 1999). Most Americans, including children, do not eat enough fruits or vegetables (Gleason, 2001). For people who eat about 2,000 calories a day, the USDA now recommends two cups of fruit and two and one-half cups of vegetables per day (Dietary Guidelines for Americans, 2005). Among high school students, only 23.6% of males and 20.3% of females eat five or more servings of fruit and vegetables per day (Eaton, 2008). In addition, children in the United States do not get as much physical activity as they should. Unfortunately for children today, screen-time is increasing, while play-time and other physical activity is decreasing. National surveys have shown a positive association between the number of hours children watch television and their risk of being overweight (Crespo, 2001). Regular physical activity is essential for a healthy life (Department of Health and Human Services, 1996). At least thirty minutes of moderate physical activity on most days of the week is the recommended minimum (Duke, 2003). However, nearly 23% of children get no free-time physical activity (Duke, 2003).

Health Risks of Childhood Obesity

Low fruit and vegetable consumption and high saturated fat intake are associated with coronary heart disease, some cancers and diabetes (Ness, 1999). Indeed, for children born in the United States in 2000, the lifetime risk of being diagnosed with type-2 diabetes at some point in their life is estimated to be 30% for boys and 40% for girls (CDC, 2008). Behavioral patterns in childhood and adolescents, including dietary and

physical activity habits, often carry over into adulthood (St-Onge, 2003). In fact, overweight adolescents have an 80% chance of becoming overweight adults (Guo, 1999). Disease risks increase substantially with increased body mass index (Thompson, 1999). In addition, there is a financial cost to our nation's obesity epidemic. Indeed, medical costs associated with obesity were estimated to be \$100 billion annually based on 1995 data (Wolf, 1998).

Prevention of Childhood Obesity

“It is the position of the American Dietetic Association, School Nutrition Association and Society for Nutrition Education that comprehensive, integrated nutrition services in schools (including nutrition education and promotion), kindergarten through grade 12, are essential components of coordinated school health programs that will improve the nutritional status, health and academic performance of our nation's children” (Briggs, 2010). According to the CDC, school-based wellness programs should:

- Provide students with opportunities to engage in healthy eating and physical activity behaviors.
- Help students develop the knowledge, skills, and attitudes necessary to adopt and maintain these behaviors.
- Integrate school-based physical activity and nutrition programs with family and community life.

Ensuring that nutrition and physical activity are taught in schools may involve innovative, nontraditional means of incorporating them into the school curriculum (Probart, 1997). Integrating nutrition and physical activity into core-subject classes would be a win-win situation for both schools and students.

Nutrition and Fitness Programs for Children

Studies suggest that overweight-prevention interventions emphasize the importance of both improved eating patterns and increased physical activity (Flynn, 2006). There are a variety of school-based nutrition and/or fitness interventions that have been successfully implemented. Next, summaries of a few of these interventions are given. An outline of the following interventions may be found in Appendix A.

The Michigan Model

The Michigan Model intervention accomplished its three main goals of increasing nutrition knowledge, increasing confidence in eating healthfully, and positively changing nutrition behavior in its participants (Fahlman, 2008). Specifically, the percent of students answering nutrition knowledge questions correctly pre- to post-test increased from 32% to 49%. In addition, students' intake of fruit increased from 2.82 to 3.25 servings/day, and their intake of vegetables increased from 1.11 to 2.03 servings/day. The Michigan Model intervention involved 783 middle school students. Participants received eight to 10 hours of instruction during an 8-lesson curriculum entitled, "What's Food Got to Do with It?" taught during their health classes. It was not stated if a specific research theory was used to create the curriculum.

Choice, Control, and Change

The Choice, Control, and Change (C3) intervention accomplished many of its goals, including improving eating behaviors and increasing overall self-efficacy (Contento et al, 2007). Specifically, results showed increased frequency of fruit consumption, from 1.60 times/day to 1.85 times/day, and increased frequency of

vegetable consumption, from 1.05 times/day to 1.20 times/day. In addition, students reduced their soda intake by 23% and their frequency of eating at fast food restaurants by 14%. Students' overall eating self-efficacy improved, as did their self-efficacy for drinking water, walking, and climbing stairs. The study involved 278 middle school students and consisted of 24 lessons. Based on the Theory of Planned Behavior, it focused on the belief that children have choices and can learn to take personal control to make healthful choices. C3 was integrated into the science curriculum and covered selected national science standards in biology and science inquiry (Lowe, 2003; Peters, 2002). A limitation of this study is that it did not have a control group with which to compare pre and post results.

Eat Well and Keep Moving

Results of the Eat Well and Keep Moving intervention showed improved dietary intake and reduced sedentary behaviors in its participants (Gortmaker, 1999). Specifically, students decreased their consumption of foods high in total fat by 1.3% and saturated fat by 0.60%; they increased their consumption of fruits and vegetables by approximately 0.73 servings/day; there was a trend toward reduced television and video viewing, but the difference was not statistically significant. While the primary outcomes of the study focused on behavior change, secondary results found increased student nutrition and fitness knowledge. Results showed that students' knowledge concerning healthy diet increased 1.4 scale points, and knowledge of healthy activities increased 0.7 scale points. The changes in knowledge scales represent a moderate effect size. The study involved 479 initially fourth grade students and consisted of 26 to 36 fifty-minute lessons. Eat Well and Keep Moving spanned two academic years and was integrated into

the core subjects of math, science, language arts, and social studies. The intervention was based on Social Cognitive Theory, and family support and cafeteria involvement were encouraged using Social Marketing techniques.

Minimal Intervention

This truly-minimal study accomplished its goals of increasing nutrition knowledge and increasing positive nutrition behavior intentions (Abood et al, 2007). Specifically, there was a significant increase of 7.7% on the mean percentage correct for the knowledge portion of the evaluation. In addition, results showed that participants significantly improved from pre-test to post-test in the percentage, responding “somewhat likely” or more on the following four items: eat fewer fried foods, eat fewer sweets, look more at food labels, and limit TV watching. The study involved 551 teenagers. Minimal Intervention consisted of two 30-minute PowerPoint presentations, and was shown in the participating students’ health classes. The lessons were developed by a private company, but it was not stated if they were based on any educational theories.

Planet Health

Results of the Planet Health intervention show a reduced prevalence of obesity and an increase in fruit and vegetable consumption among girls (Gortmaker, 1999). Specifically, obesity prevalence among female students in the *control* schools increased from 21.5% to 23.7% over the two school-year intervention periods, while the *intervention* schools’ prevalence declined from 23.6% to 20.3%. In addition, fruit and vegetable consumption increased by 0.32 servings/day for girls. No significant results were found for boys in these two areas. Planet Health involved 1,295 middle school students and spanned two academic years. The intervention, based on Social Cognitive

Theory, consisted of 32 lessons integrated into the subjects of science, math, language arts, social studies, and physical education.

High 5

The High 5 intervention accomplished its main goal of increasing fruit and vegetable consumption among participants at Follow-up 1 (six months post intervention) and at Follow-up 2 (one year post intervention) (Reynolds, 2000). Specifically, servings of fruits and vegetables (combined) increased from 2.61 servings/day to 3.96 servings/day at Follow-up 1, and to 3.20 servings/day at Follow-up 2. In addition, increases in fruit and vegetable consumption were seen for participants' parents at Follow-up 1. Knowledge of the food guide pyramid and knowledge of *5 A Day* servings also increased from baseline to Follow-up 1 and Follow-up 2 for participants. The High 5 study included 1,698 families of fourth graders from 28 elementary schools. It used an immediate intervention condition and a delayed intervention control condition, so all students in the study had a to chance benefit from the intervention. The intervention was based on Social Cognitive Theory and it had three components: classroom, parent, and cafeteria. The classroom component consisted of 14 bi-weekly lessons and one day per week where participants and their parents were encouraged to eat five servings of fruit and vegetables.

EatFit

The WIM intervention was based on the successful EatFit pilot study. Therefore, more details regarding EatFit are given here. EatFit was a goal-oriented intervention that was successful in increasing nutrition and fitness knowledge, as well as improving the dietary and physical activity behaviors of middle school students aged 11 to 14 years

(Horowitz et al, 2008). The intervention contained three components: a workbook, a web-based assessment, and a nine-lesson curriculum. The 20-page, magazine-style workbook contained photos and images that appeal to this age group. It also contained worksheets that reinforced what was learned in each lesson. The web-based assessment allowed each student to input his/her 24-hour diet log. The program then generated personalized dietary feedback, goal-setting recommendations, and a nutrition contract. The nine-lesson curriculum included activities on setting goals, monitoring progress, practicing healthful behaviors and physical activities, reading food labels, and dealing with media influences. Thirty-four *Expanded Food and Nutrition Education Program* (EFNEP) middle school students participated in the EatFit program. Self-reported recall instruments indicated positive changes in dietary and physical activity behavior and improved dietary and physical activity self-efficacy. EatFit was designed based on Social Cognitive Theory (SCT). The main tenets of SCT that drove the intervention were social support, self-efficacy, outcome expectancies, and self-regulation. During middle-school, friends' opinions, attitudes and support are of utmost importance. EatFit utilized this fact by placing students in groups according to their nutrition and physical activity goals. Students at this age often need to experience success and a sense of accomplishment before they are motivated to proceed forward. EatFit helped students develop confidence by allowing time for food tastings, recipe preparation demonstrations, and guided physical activity practice. The developers of EatFit held focus groups to determine the most important influences of students at this age. They found that improved appearance, increased energy, and increased independence were the outcome expectancies that most likely would motivate students to stick with the EatFit program. Therefore, the program

was developed with these expectations in mind. Many behavior change theories recognize the importance of goal setting and self-regulation in order to make lasting changes. The EatFit curriculum included lessons on goal-setting, self-monitoring, barrier counseling and reinforcement. Each student sets individual goals based on the results of their web-based, 24-hour diet log assessment. The workbook contained self-monitoring lessons so that students could determine if they were staying on track. Students, along with their teacher, brainstormed possible barriers that could hinder their progress. They also discussed solutions to these foreseeable problems. Appendix B outlines how components of Social Cognitive Theory are utilized in EatFit.

Theoretical Basis for WIM: Social Cognitive Theory

Most of the interventions discussed above were based on Social Cognitive Theory (SCT) because SCT has been proven to guide many successful school-based interventions (Baranowski, 1997). This theoretical framework uses cognitive, environmental, and behavioral variables to explain and describe human behavior and learning (Bandura, 1986). It also provides the basis for intervention and learning strategies used to change behavior (McAlister, 2008). Social Cognitive Theory has become the most widely used theory for designing nutrition education programs/curricula because it helps nutrition educators understand why their audiences behave the way they do, as well as how to best help them make needed behavior changes (Contento, 2007). The ultimate goal of any nutrition education intervention is for the participants to make and maintain positive changes in their nutrition behavior. This is a difficult task because behavior change takes time. There are several phases of behavior change including the pre-action phase and the action phase. Beliefs and feelings predominate in the pre-action

phase. Subject-specific knowledge and skills, as well as self-regulatory processes, predominate the action phase (Contento, 2007). Although this paper focuses only on the participants' acquisition of nutrition, fitness, and math knowledge, the WIM Intervention was designed using SCT to achieve the "gold standard" of nutrition education: positive behavior change as well as the maintenance of that change. An outline of how the components of Social Cognitive Theory were applied to the WIM curriculum is found in Appendix D.

Integration of Nutrition and Fitness into the Mathematics Curriculum

The middle school mathematics curriculum can accommodate both nutrition education and physical activity education. Nutrition education involves extensive numerical analyses and calculations. Reading and understanding food labels, figuring out appropriate caloric intake, and calculating one's body mass index (BMI) are just three examples. Physical activity education also relies on accurate numerical calculations. Examples include finding one's maximum heart-rate, or the number of calories one can burn while performing a particular exercise for a given amount of time. Students reinforce their number and operation skills while learning to solve interesting, real-world problems (Seeley, 2004). By utilizing nutrition and physical activity examples relevant to each student's own life and interests, the curriculum itself becomes a motivator for students to learn. Test results, referred to in *The American Mathematical Monthly*, indicate that students learning mathematics from an integrated curriculum demonstrate better conceptual understanding and problem solving than students studying from a traditional course sequence (Schoen, 2003).

CHAPTER 3

METHODS

The WIM Curriculum

WIM, a 4-week math unit teaching proportional reasoning, was designed using best practices and was based on Colorado Math Standards. The curriculum taught required math standards using nutrition and fitness examples. WIM consisted of nine interactive lessons including one food preparation demonstration and two food tastings. Classes were to be held twice a week, lasting from 45-90 minutes each. Similar to EatFit, the students participating in the WIM curriculum entered 24-hour diet logs into a nutrition database and used their individual results to set and monitor goals. In addition, to increase nutrition and fitness self-efficacy, they participated in food tastings, food preparations demonstrations, and physical fitness practice. To integrate math into the curriculum, students did recipe conversions, collected data, created bar and pie graphs, and determined the number of calories they could burn while performing a specific exercise. For example, Table 1 gives an overview of the WIM curriculum and is found at the end of this chapter. Please see Appendix D for the entire WIM curriculum.

Rationale for the WIM Curriculum

As discussed in Chapter 2, there are plenty of school-based interventions that integrate nutrition and/or fitness into the core curriculum. Many of these studies report increased nutrition and/or fitness knowledge as well as positive behavior change. There

is little research, however, reporting the effects that these integrations have on knowledge acquisition of the core-subject. Is core-subject knowledge in math, for example, compromised because more time is spent teaching nutrition and/or fitness topics? The WIM project answers this question. WIM aimed at providing the participating students with knowledge about nutrition and fitness while successfully teaching required mathematical concepts. The objective of the WIM intervention was to increase participating students' nutrition and fitness knowledge, without compromising required mathematical knowledge acquisition.

Research Questions

- 1) Do the students in the intervention group differ significantly from those in the comparison group in regard to their average WIM pre-test and post-test nutrition scores?
- 2) Do the students in the intervention group differ significantly from those in the comparison group in regard to their average WIM pre-test and post-test fitness scores?
- 3) Do the students in the intervention group differ significantly from those in the comparison group in regard to their average pre-test and post-test math scores?

Research Design

Two groups of students participated in this research project. The students who received the WIM intervention constituted the experimental/intervention group, and the students who were not involved in the intervention constituted a control/comparison group. The term control/comparison is used, because in the literature researchers such as Borman (2003, 2005) use the term “quasi-experimental, non-equivalent, control group

design” for this kind of study. However, others, such as Whitehurst (2003), use the term quasi-experimental “non-randomized, comparison group design.” This study is quasi-experimental because the selection process was non-randomized and used non-equivalent groups. The selection of the student participants was not in the researcher’s control. As a result, neither the school nor the students were randomly selected, as would be required for this study to be a randomized-experimental design. Rather, the groups were selected through the process of “matching” the experimental/intervention group with a similar, yet non-equivalent, control/comparison group. Hence this study could best be termed a *quasi-experimental, non-equivalent/non-randomized, control/comparison design*. For ease, the terms “intervention group” and “comparison group” are used.

Participants

Participants came from five 8th grade math classes at a junior high school in Fort Collins, Colorado. Students were assigned to specific math classes by their school at the beginning of the school year (August 2008). These classes were not reorganized for the purpose of this study.

One class was assigned to the pilot group (taught by teacher y). This class received the WIM program for pilot-testing purposes. The pilot group also helped to establish the internal consistency and test-retest reliability of the WIM evaluation tool: WIM-Questionnaire (WIM-Q). The pilot group received the WIM program during the months of January and February of 2009.

Two classes were assigned to the comparison group (taught by teacher x). They did not receive the WIM program, but studied proportional reasoning in the traditional way, which included learning about proportionality by finding missing side lengths of

similar geometric figures, as well as solving problems involving distance and time. The last two classes were assigned to the intervention group (taught by teacher y). These classes received the WIM program. The intervention groups received the WIM program during the months of March and April of 2009. The comparison groups studied their traditional unit (covering the same math standards as the WIM program, but without the nutrition and fitness examples) during the same time frame as the intervention group.

Protection of Human Subjects

Students were excluded if their written assent (Appendix E) or the written consent of parents or caregivers (Appendix F) was not received. The Institutional Review Board of Colorado State University and the Poudre School District approved all procedures.

Evaluation Tools

Before the WIM program was taught to the intervention groups, the following two pre-test evaluation tools were administered to both the intervention group classes and the comparison group classes: 1) The Wellness Integrated Mathematics Questionnaire (WIM-Q), and 2) The Ratios and Proportions Math Exam (RPME). The WIM-Q was designed to evaluate self-efficacy, self-regulation, attitudes, behaviors, and knowledge regarding nutrition and fitness before and after the WIM intervention or traditional math unit. For this thesis, only nutrition knowledge and fitness knowledge were evaluated using the WIM-Q. The other four components are discussed in the paper: *Validation, Reliability and Results from a Measure to Assess Middle School Students' Change in Nutrition and Physical Activity Factors* written by Wan Ju Liao, Fall 2009. The Ratios and Proportions Math Exam evaluated math knowledge for both the comparison and intervention groups before and after the WIM intervention or traditional math unit. The

WIM-Q is found in Appendix G, and the Ratios and Proportions Math Exam is found in Appendix H.

Wellness Integrated Mathematics-Questionnaire (WIM-Q)

WIM-Q was developed and tested for validity and reliability before the WIM Intervention began. The nutrition and fitness sections of the WIM-Q were found to be both valid and reliable (Liao, 2009). Two nutrition professionals established content validity by independently determining if each question effectively evaluated one or more specific lesson components of the WIM curriculum. Each question in the nutrition and fitness sections of the WIM-Q aligned appropriately to a specific area or areas of the WIM curriculum. The pilot group, as described earlier, was used to determine test-retest reliability and internal consistency of the WIM-Q. Data were analyzed using Statistical Package for the Social Sciences, SPSS software (SPSS, Inc. Chicago, IL), and a Cronbach's alpha coefficient greater than or equal to 0.7 was considered to be sufficiently reliable (Windsor, 2004). The Cronbach's alpha coefficient for the nutrition section of the WIM-Q was 0.75. The Cronbach's alpha coefficient for the fitness section of the WIM-Q was 0.56. However, if question 11.g was omitted from the fitness section, the coefficient became 0.73. The deletion of question 11.g is discussed in the *Results* section of this paper. The nutritional knowledge portion of the WIM-Q contained 10 questions worth one point each. The contents of each question are outlined in Table 2. The fitness knowledge portion of the WIM-Q contained 11 questions worth one point each. The contents of each question are outlined in Table 3. Both tables can be found at the end of this chapter.

Ratios and Proportions Math Exam

Evidence for content validity was established in the Ratios and Proportions Math Exam as it was written by three eighth-grade math teachers at the participating junior high school and based on current Colorado Mathematics Standards. To establish reliability, RPME was tested for internal consistency. Data were analyzed using SPSS software, and a Cronbach's alpha coefficient greater than or equal to 0.7 was considered to be sufficiently reliable (Windsor, 2004). The Cronbach's alpha coefficient for the RPME pre-test was .806, and for the RPME post-test it was .761. Therefore, this evaluation tool is considered reliable. There were seven sections of the RPME and a total of 55 points. Table 4 provides an overview of the Ratios and Proportions Math Exam, and can be found at the end of this chapter.

Data Collection Procedures

The WIM-Q and RPME (pre and post-tests) were administered to the comparison group and the intervention group by teachers x and y, respectively, before and after the WIM intervention and traditional math unit were taught. Teacher x and teacher y together developed both the exam and its rubric. In addition, the teachers graded several exams together to establish even more consistency in the grading process. Teacher x graded the comparison group's pre and post RPME's. Teacher y graded the intervention group's pre and post RPME's. Teacher y scored all of the WIM-Q's for both groups.

Statistical Methods

WIM-Q and RPME pre- and post-test scores were analyzed only for those students who completed both the pre- and post-tests. Pre- and post-test data were entered into the Statistical Package for Social Sciences (SPSS). A paired samples *t*-test analysis was conducted. Pre-test and post-test scores were compared employing a pre-test-post-test non-equivalent-groups design (Morgan et al, 2006). Effect sizes were calculated using Cohen's *d* (Cohen, 1988). *d* measures the practical significance of a given result. It is a scale-free measure of the separation between two group means expressed in terms of their common standard deviation or that of the untreated population. Thus, a *d* of .25 indicates that one-quarter standard deviation separates the two means (Valentine, 2003). Cohen labeled an effect size small if $.20 < d < .50$. He suggested large magnitudes of effect were $d \geq .80$. Medium-sized effects were placed between these two extremes, that is, $.50 \leq d < .80$ (Valentine, 2003). Alpha was set at $p < .05$.

Table 1: An Overview of the WIM Curriculum

Week & Day	Lesson Number & Evaluation	Length of Lesson	Math Concepts Covered	Nutrition Concepts Covered	Fitness Concepts Covered
Week 1 Day 1	WIM-Q (pre-test) RPE (pre-test) Lesson 1	20 min 25 min 45 min	Define: Ratio and Proportion Create Bar Graphs Write Ratios Solve Proportions Use Protractor Find Angles Create Pie Charts	Answer the following questions: 1) What does it mean to eat healthfully? 2) Why is it important to eat healthfully?	Answer the following questions: 1) What does it mean to be physically fit? 2) Why is it important to be physically fit?
Week 1 Day 2	Lesson 2	60 min	Estimate Volume Conversions (ie: ounces to cups)	Learn serving sizes for fruits, vegetables, starches, protein, and fats. Complete a one-day food journal with serving size estimates.	NA
Week 2 Day 1	Lesson 3	90 min	Enter individual data into government database (MyPyramid.gov). Use proportions to find percentages.	Calculate percent of recommended intake for specific food groups. Goal Setting. Goal Tracking	NA
Week 2 Day 2	Lesson 4	90 min	Estimate time and weight. Use proportions to find percentages.	NA	Calculate percent of recommended time for specific exercise. Goal Setting. Goal Tracking.
Week 3 Day 1	Lesson 5	90 min	Estimate heart rate. Estimate calories in foods. Estimate calories burned for given activity. Use ratios and proportions to solve problems.	Discuss relationship between intake of energy (food) and output of energy (living and moving).	Find individual heart rate. Discuss how and why heart rate increases with exercise intensity. Calculate calories burned for specific exercises. Practice specific exercises.
Week 3 Day 2	Lesson 6	90 min	Find information on a chart and use it to solve problems. Use ratios and proportions to solve problems.	Read Food Label Calculate percent of total carbohydrate, protein and fat in a given food using a food label.	Review relationship between energy in and energy out.
Week 4 Day 1	Lesson 7		Use proportions to determine the amount of sugar, salt and fat in a given meal.	When the amounts of sugar, salt and fat for given meal are known, visualize these amounts using real salt, sugar and Crisco.	Review relationship between energy in and energy out.
Week 4 Day 2	Lesson 8	90 min	Perform class survey. Analyze results of survey. Use ratios and proportions to create pie charts to represent the results of the survey.	Food Tasting. Discuss specific nutrients (fiber, vitamin C and vitamin b6) and how they contribute to our health.	NA
Week 4 Day 3	Lesson 9	90 min	Use ratios and proportions to increase and decrease recipe size. Use ratios and proportions to determine the percent RDI of specific nutrients in one serving of hummus.	Food Preparation (Hummus) Demonstration. Learn the nutritional value of hummus per serving, specifically: total carbohydrate, fiber, protein and fat.	NA
Week 5 Day 1	WIM-Q (post-test) RPE (post-test)	45 min	All in unit.	All in unit.	All in unit.

Table 2: Nutrition Knowledge Components of the WIM-Q

Question	Content Evaluated
10.a.1	Dairy is a good source of calcium.
10.a.2	If you don't get enough iron, you may feel tired.
10.a.3	Fat is the most caloric-dense macronutrient.
10.a.4	Fruits and vegetables contain fiber which is good for digestion
10.b	Finding the serving size on a food label.
10.c	Finding the amount of sodium on a food label.
10.d	Stating the amount of vegetables recommended each day for teenagers.
10.e	Stating the amount of milk (or milk equivalents) recommended each day.
10.f	Calories measure energy supplied by food.
10.g	The number of calories recommended each day depends on the individual.

Table 3: Fitness Knowledge Components of the WIM-Q

Question	Content Evaluated
11.a.1	Squats represent a strength activity.
11.a.2	Jogging is an example of an aerobic activity.
11.a.3	Yoga involves stretching.
11.a.4	Bowling is considered a lifestyle activity.
11.b	Strength activities tone muscles.
11.c	Most teenagers should do some type of exercise every day of the week.
11.d	Lifestyle activities like gardening and playing Frisbee count as exercise.
11.e	Food provides the energy you need to move and think.
11.f	Weight gain occurs when "energy-in" is greater than "energy-out."
11.g	Increasing heart rate can increase the amount of calories burned.
11.h	Aerobic activity burns more calories than weight training.

Table 4: Overview of Ratios and Proportions Math Exam

Section	Number of Problems in Section	Number of Points per Problem	Total Points in Section	Overall Percent of Exam	Math Concept Tested in Section
1	3	2	6	12%	Ratios & Rates
2	3	2	6	12%	Solve proportions using scale factors.
3	4	3	12	24%	Use proportions to solve problems involving conversions.
4	2	2	4	8%	Use proportions to solve problems involving similar figures.
5	4	3	12	24%	Use proportions to solve problems involving percents.
6	3	3	9	12%	Use proportions to convert from percents to degrees in a circle.
7	4	1	4	8%	Given degree measures, use protractor to create pie graph.

CHAPTER 4

RESULTS

Demographics of the Intervention and Comparison Groups

One hundred and five eighth-grade students (44.8% boys and 55.2% girls) between 13 and 15 years of age were recruited for the WIM Intervention. Fifty-two students from two different math classrooms were assigned to the comparison group and were taught by teacher x. Fifty-three students from two different math classrooms were assigned to the intervention group and were taught by teacher y. Most students (91.5%) spoke English at home. There was no significant difference in the distribution of language spoken, age, or gender of the two groups.

WIM Intervention Implementation

The intervention group received the 9-lesson WIM Intervention over a 4-week period during the months of March and April of 2009. Each lesson lasted between 45 and 90 minutes. The comparison group received their traditional proportional reasoning math unit during the same 4-week period. Pre-tests were given on the first day of the intervention, and post-tests were given within a week after the intervention.

Nutrition Knowledge Results

Research Question 1: Do the students in the intervention group differ significantly than those in the comparison group in regard to their average WIM-Q pre-test and post-test nutrition scores? Bolded p-values show statistical significance. Table 5

shows overall mean scores for nutrition knowledge on the WIM-Q pre- and post-tests for the intervention group and the comparison group.

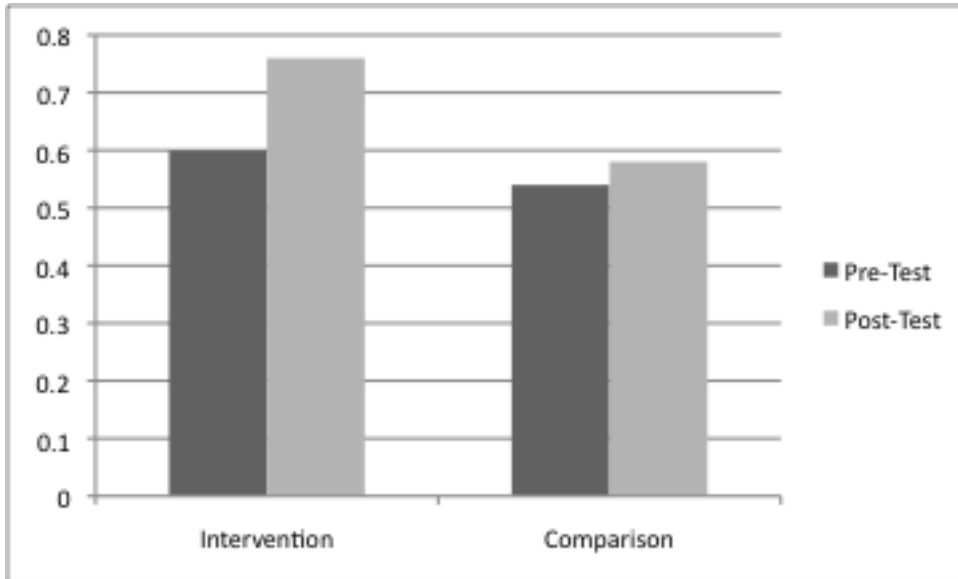
Table 5: Nutrition Pre-Test and Post-Test Overall Mean Differences

	n	M	SD	<i>t</i>	<i>p</i>	<i>d</i>
Intervention Group				-4.920	.000	.759
Pre-test	48	.60	.172			
Post-test	48	.76	.196			
Comparison Group				-1.158	.253	.173
Pre-test	47	.54	.483			
Post-test	47	.58	.425			

Data in Table 5 also report outcomes of a paired samples *t*-test for the overall mean scores on the nutrition knowledge section of the WIM-Q for the intervention group and the comparison group. Table 5 shows the overall mean differences revealed a statistically significant difference between the pre-test and post-test scores for the intervention group. There was not a statistically significant difference between the pre-test and post-test scores for the comparison group. According to Cohen (1988), the overall mean difference between the pre-test and the post-test for the intervention group revealed a medium effect size.

Figure 1 is a bar graph showing overall mean scores for nutrition knowledge on the WIM-Q pre- and post-tests for the intervention group and the comparison group. As stated in Table 5, post-test scores for the intervention group showed significant results.

Figure 1: WIM-Q Nutrition Pre-Test and Post-Test Overall Mean Differences



Appendix I shows mean scores (per question) for nutrition knowledge on the WIM-Q pre- and post-tests for the intervention group and the comparison group. Data in Appendix I report outcomes of a paired samples *t*-test for each question on the nutrition knowledge section of the WIM-Q. Appendix I shows these mean differences revealed statistically significant differences between the pre-test and post-test scores for students in the intervention group on the following survey questions: 10.d, 10.e, 10.f and 10.g. There were no statistically significant differences between the pre-test and post-test scores for students in the comparison group. According to Cohen (1988), the effect sizes of these mean differences between the pre-test and the post-test for the intervention group revealed large effect sizes for answers to question 10.e ($d=.886$) and 10.f ($d=.806$), medium effect size for question 10.d ($d=.663$), and small effect size for question 10.g ($d=.360$).

Fitness Knowledge Results

Research Question 2: Do the students in the intervention group differ significantly than those in the comparison group in regard to their average WIM-Q pre-test and post-test fitness scores? Table 6 shows overall mean scores for fitness knowledge on the WIM-Q pre- and post-tests for the intervention group and the comparison group.

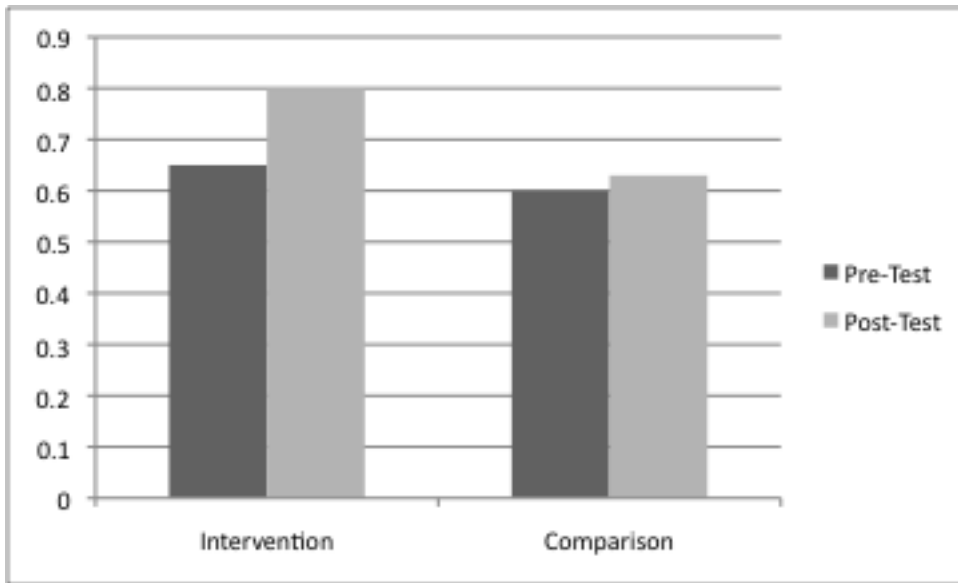
Table 6: WIM-Q Fitness Pre-Test and Post-Test Overall Mean Differences

	n	M	SD	<i>t</i>	<i>p</i>	<i>d</i>
Intervention Group				-4.491	.000	.803
Pre-test	48	.65	.208			
Post-test	48	.80	.163			
Comparison Group				-.910	.368	.148
Pre-test	47	.60	.199			
Post-test	47	.63	.205			

Data in Table 6 report outcomes of a paired samples *t*-test for the overall mean scores on the fitness knowledge section of the WIM-Q for the intervention group and the comparison group. Table 6 shows the overall mean differences revealed a statistically significant difference between the pre-test and post-test scores for the intervention group. There was not a statistically significant difference between the pre-test and post-test scores for the comparison group. According to Cohen (1988), the overall mean difference between the pre-test and the post-test for the intervention group revealed a large effect size.

Figure 2 is a bar graph showing overall mean scores for fitness knowledge on the WIM-Q pre- and post-tests for the intervention group and the comparison group. As stated in Table 6, significant post-test results were seen for the intervention group.

Figure 2: WIM-Q Fitness Pre-Test and Post-Test Overall Mean Differences



Appendix J shows mean scores (per question) for fitness knowledge on the WIM-Q pre- and post-tests for the intervention group and the comparison group. Data in Appendix J report the outcome of a paired samples *t*-test. Appendix J shows these mean differences revealed statistically significant differences between the pre-test and post-test scores for students in the intervention group on the following survey questions: 11.a.1, 11.a.3, 11.a.4, 11.b, 11.d, 11.f, 11.g and 11.h. There were no statistically significant differences between the pre-test and post-test scores for students in the comparison group. According to Cohen (1988), the effect sizes of these mean differences between the pre-test and the post-test for the intervention group revealed medium effect sizes for

questions 11.a.1 ($d=.659$), 11.a.3 ($d=.741$), 11.d ($d=.573$), 11.g ($d=-.685$), 11.h ($d=.625$), and small effect sizes for questions 11.a.4 ($d=.458$), 11.b ($d=.363$), and 11.f ($d=.458$).

Math Knowledge Results

Research Question 3: Do the students in the intervention group differ significantly than those in the comparison group in regard to their average Ratios and Proportions Math Exam (RPME) pre-test and post-test scores? Table 7 shows overall mean and percentage scores for math knowledge on the RPME pre- and post-tests for the intervention group and the comparison group.

Table 7: Ratios and Proportions Math Exam Pre-Test and Post-Test Overall Mean and Percent Differences

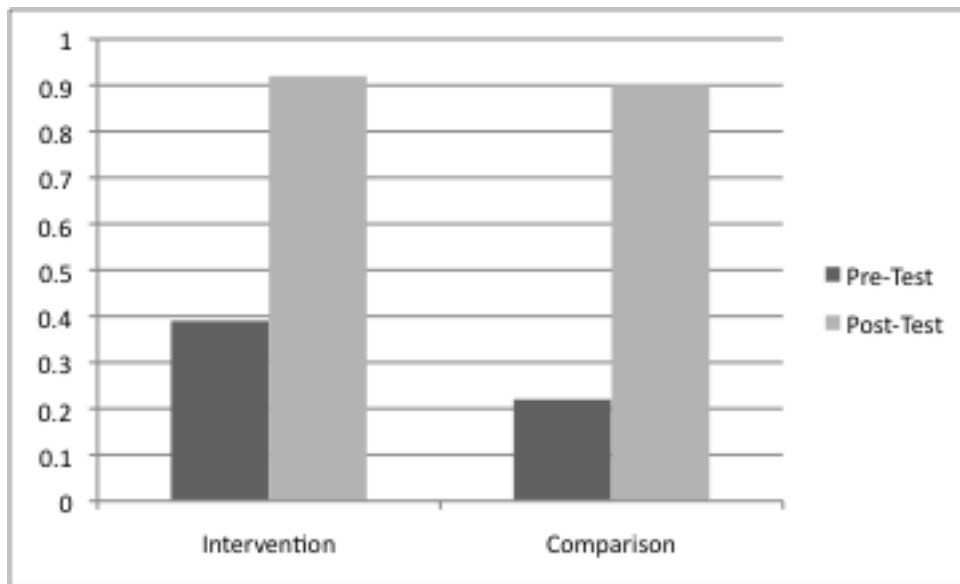
	n	M	%	SD	<i>t</i>	<i>p</i>	<i>d</i>
Intervention Group					-15.654	.000	2.603
Pre-test	48	3.0342	39	2.064			
Post-test	48	7.2143	92	.956			
Comparison Group					-23.229	.000	3.977
Pre-test	43	1.7457	22	1.404			
Post-test	43	7.0332	90	1.254			

Data in Table 7 report outcomes of a paired samples *t*-test for the overall mean scores on the Ratios and Proportions Mathematics Exam for the intervention group and the comparison group. Table 7 shows the overall mean differences revealed a statistically significant difference between the pre-test and post-test scores for the intervention group and the comparison group. According to Cohen (1988), the overall mean differences between the pre-test and the post-test for the intervention group and the comparison group revealed large effect sizes.

Results of a non-paired t -test comparing the intervention group's mean pre-test score with the comparison group's mean pre-test score reveal significant differences at baseline. The intervention group's mean pre-test score was 3.0342 (39%), and the comparison group's mean pre-test score was 1.7475 (22%) with $p = .001$. There was not a significant difference in the two groups' post-test scores.

Figure 3 is a bar graph showing overall % scores for math knowledge on the RPME pre- and post-tests for the intervention group and the comparison group. As seen in Table 7, both the intervention group and the comparison group showed significant improvement on post-test scores.

Figure 3: Math Pre-Test and Post-Test Overall % Differences



Appendix K shows mean and percent scores per section for math knowledge on the RPME pre- and post-tests for the intervention group and the comparison group. Data in Appendix K report the outcome of a paired samples t -test. Appendix K shows the mean differences revealed statistically significant differences between the pre-test and post-test scores for students in the intervention group as well as students in the

comparison group on all sections of the exam. According to Cohen (1988), the effect sizes of these mean differences between the pre-test and the post-test for students in the intervention group revealed large effect sizes for all sections except section 7. The effect size of section 7 for the intervention group was medium. The effect sizes of the mean differences between the pre-test and the post-test scores for students in the comparison group revealed large effect sizes for all sections.

CHAPTER 5

DISCUSSION AND CONCLUSION

Nutrition Results

The intervention group had considerably higher mean *pre-test* scores for questions 10.a.1, 10.a.2, 10.a.3, 10.a.4, 10.b and 10.c. than the comparison group. These questions tested knowledge regarding calcium, iron, fat, fruits, vegetables, and reading food labels. A possible explanation for this result is that an elective class entitled *Creative Foods* was offered at the participating junior high school during the 2008-2009 school year.

Nutrition concepts and cooking skills were taught in that class. It was discovered, after an informal survey, that the number of students in the intervention group who had also taken, or were currently taking, *Creative Foods* was about seven (approximately 15% of the intervention group). The number of students in the comparison group who took, or were taking, this elective class was not known. It could be hypothesized that more students in the intervention group were in the *Creative Foods* class compared to the comparison group, confounding the results and leading to these different baseline values. Although both the intervention group and the comparison group showed gains on most of these items from pre-test to post-test, none was significantly different.

The intervention group scored lower on *pre-test* questions 10.d, 10.e and 10.f. These were questions regarding the correct serving size and number of servings recommended from each food group for teenagers, as well as the definition of a calorie.

The intervention group, however, made significant improvements on these questions from pre-test to post-test, while the comparison group did not. During the WIM intervention, number of servings, as well as serving sizes for key food groups, were emphasized, including grains, fruits, vegetables, protein, fat, and dairy products. In addition, a goal of the WIM Intervention was teaching students that calories are supplied by food and they provide the energy needed to move and think. After the WIM intervention, more students could state appropriate serving sizes as well as the daily number of servings needed from key food groups (questions 10.d and 10.e), and they could explain what a calorie is and what factors contribute to individual caloric needs (10.f and 10.g). While knowledge acquisition does not automatically lead to behavior change, according to Social Cognitive Theory, food- and nutrition-related knowledge and skills (behavioral capabilities) are prerequisites to carrying out intended changes in behavior (Contento, 2007). Although improving behavior is the “gold standard” of any nutrition intervention, important studies, such as the *Michigan Model, Eat Well and Keep Moving*, and *Minimal Intervention*, list nutrition-related knowledge acquisition as a positive outcome (Abood, 2008; Fahlman, 2008; Gortmaker, 1999).

Fitness Results

In general, both the intervention group and the comparison group had higher *pre-test* fitness knowledge than *pre-test* nutrition knowledge. There was, however, room for improvement. Improvements were seen from the intervention group on all fitness questions, and statistically significant improvements were seen on eight of the 11 questions. The students in the intervention group improved significantly on questions 11.a.1, 11.a.3, 11.a.4, 11.b, 11.d, 11.f, and 11.h. These were questions regarding types of

exercise and the concept of energy balance. The comparison group did not make any significant gains in the fitness section. During the WIM interventions, students discussed the importance of strength training, aerobic activity, stretching, and lifestyle activities. They also had time in class to practice these activities. After the intervention, most students in the intervention group correctly reported that exercise is anything that involves moving one's body, including house chores and gardening (question 11.d). WIM also stressed the importance of eating healthy food to fuel the body and provide it with the energy it needs to move and think. The relationship between "energy in" (food) and "energy out" (living, moving, thinking...) was frequently discussed (question 11.f).

Interestingly, the students in the intervention group showed a significant decline from pre-test to post-test on question 11.g (the higher your heart rate, the more calories you burn). A possible reason for this result is that, during the WIM intervention the students were informed that maximum fat-burning does *not* occur during workouts of maximum intensity. The students could have been confused about fat-burning versus calorie-burning as it relates to heart rate.

As with nutrition knowledge, fitness knowledge is a "behavior capability" that influences positive behavior change. Although some nutrition and fitness interventions at the middle school level, such as EatFit (Horowitz, 2004) have been successful at changing physical activity behavior, many factors must be in place for positive behavior change to occur. The *Eat Well and Keep Moving Intervention* (Gortmaker, 1999), for example, succeeded in reducing television viewing in its participants, but did not succeed at increasing their vigorous physical activity. A number of influencing issues regarding these results were mentioned in the study. For example, the students involved in the

study had limited physical education programs in-school and minimal after-school fitness programs available to them. Barriers such as these can make intended behavior change nearly impossible.

Mathematics Results

The Ratios and Proportions Math Exam mean *pre-test* score for the intervention group revealed significantly higher math knowledge compared to the comparison group. A possible reason for this result is that all of the students in the comparison group were in the math class of teacher x, and all students in the intervention group had attended the math class of teacher y for about seven months—from August 2008 to March 2009—prior to, as well as during, the intervention. Differences in teaching style, and more or less emphasis on specific math topics, could have caused these differences.

Both the intervention group and the comparison group made significant improvements in all seven sections of the math exam. This result was to be expected since both groups were taught the same math standard (proportional reasoning) during the 4-week math unit. The difference was that the intervention group was taught proportional reasoning using the WIM curriculum, which incorporated nutrition and fitness examples throughout, and the comparison group was taught proportional reasoning using a traditional method as discussed in Chapter 3. A possible ceiling effect was observed with the RPME, as both groups' post-test percentages were in the 90s.

WIM Strengths

A strength of the WIM Intervention is that it integrates nutrition and fitness into a core subject: mathematics. Students used and analyzed their own personal nutrition and fitness data to make predictions and to solve real-life problems. Educational leaders in

the field of mathematics have recommended this personalized approach. Cathy Seeley, former president of the National Council of Teachers of Mathematics, stated that students in middle school should explore a wide variety of interesting topics and still achieve computational proficiency. By including a strong emphasis on data analysis and statistics within a comprehensive and balanced program, students reinforce their number and operational skills while learning to solve interesting, real-world problems (Seeley, 2004). In addition, the Center for Disease Control and Prevention recommends that policy makers, health advocates, and the general public be educated about the importance of requiring daily physical education classes and evidence-based nutrition education in the core curriculum in kindergarten through 12th grade (Macera, 2010). WIM successfully taught nutrition and fitness concepts in a mathematics class while increasing the students' core subject knowledge acquisition.

Another strength of the WIM Intervention is that it is based on Social Cognitive Theory. During WIM, students benefited from many of the components of SCT: they actively participated in classroom instruction through food tastings and physical fitness practice (Observational Learning, Modeling and Self-Efficacy); they watched a food preparation demonstration and used food models to estimate serving sizes (Observational Learning and Modeling); they used a government database to determine their own nutritional shortcomings and to set specific nutrition and fitness goals based on their individual needs (Self Regulation/ Self Control); they discussed potential barriers to achieving their goals and brainstormed possible solutions to them (Self Regulation/ Self Control); and they gained knowledge and skills needed to make important changes in behaviors (Behavioral Capability). In general, students are engaged by problems that

pertain to their own lives and are intrinsically motivated to solve them. The WIM Intervention enabled students to be the center of their own education.

WIM Limitations

Teacher y taught both intervention group classes (48 students) and teacher x taught both comparison group classes (47 students). This fact makes it difficult to determine if teacher y had an influence on the results of the intervention. A better design would have been for each teacher to teach one intervention group class and one comparison group class. However, this was not possible due to logistical constraints.

Teacher y, the intervention group teacher, included a few traditional math examples involving similar figures such as the ones in section 4 of the Ratios and Proportions Math Exam found in Appendix H. Instead, teacher y could have utilized the shape of the Food Guide Pyramid in varying sizes to teach the same math concept: corresponding sides of similar triangles are proportional.

As reported in a separate paper (Liao, 2009), improved nutrition and fitness behavior was not seen as a post-intervention outcome of WIM. WIM was a relatively short intervention, consisting of nine lessons and about 12 hours of instruction time. Some shorter interventions, such as *The Michigan Model*, *Minimal Intervention*, and *EatFit*, showed positive nutrition and/or fitness behavior changes as outlined in Chapter 2. However, The School Health Education Evaluation Study (Connell, 1985) reported that program-specific effects occur after 10 hours of classroom learning, but that it generally takes an average of 50 hours of instruction to change behavior. Therefore, it is consistent with the literature that behavior change was not seen as an outcome of WIM.

Another debatable limitation of WIM was that it did not have a parental component such as those seen in *Eat Well and Keep Moving* and in *High 5*. Some research demonstrates that parental involvement in school-based nutrition education makes a positive difference for younger children (Contento, 1992). However, other studies focusing on older children indicate no impact from parent involvement on student diet (Luepker, 1992). At the middle school level, students often have more control over what they choose to eat (at school and during social activities) than those of elementary-aged students. However, it is important to educate the parents of these young adults, because in most cases the parents and/or guardians are the ones buying the food that the kids eat at home. Therefore, it is likely that a parental component of WIM could contribute to positive and lasting behavior changes.

Finally, there was not a cafeteria component in the WIM Intervention. Research has shown that behavior change is more likely to endure when a person's environment is simultaneously changed in a manner that supports the behavior change (Macera, 2010). At the middle school level, students are greatly influenced by their peers. Perhaps healthier lunchroom options supported by a "cool" Social Marketing campaign, such as the one seen in *Eat Well and Keep Moving* (Gortmaker, 1999), would increase the probability of positive behavior change.

Recommendations

WIM, a 9-lesson intervention that delivered about 12 hours of instruction time, accomplished its goals of increasing nutrition, fitness, and math knowledge in its participants. Expanding WIM to offer at least 50 hours of instruction may increase the probability of positive behavior change. This could easily be done because many other

nutrition and fitness concepts could be integrated into several other 8th grade math standards such as algebra, problem solving, estimating, and measuring. In addition, booster lessons (refresher lessons given in subsequent years), such as those seen in the *High 5 Intervention*, may be used to increase long-term effects (Reynolds, 2000).

The addition of garden, kitchen-classroom, and cafeteria components would be ideal. According to Alice Waters, the founder of the *Edible Schoolyard* in Berkley, California: “When kids grow it and cook it, they eat it” (Waters, 2009). Student involvement also is a key element in the *Cooking With Kids (CWK)* program from Albuquerque, New Mexico. *CWK* utilizes constructs of Social Cognitive Theory in cooking lessons and tasting lessons to encourage elementary school children’s innate curiosity and enthusiasm for food through direct experience with fresh, affordable foods (Walters & Stacey, 2009). Allowing students to experience food in its natural form, that is, not pre-packaged and microwaved, promotes reflection on what they are using to fuel their body as well as how their actions affect the Earth.

The WIM curriculum provides unlimited opportunities for cross-curricular collaborations between teachers in all subject areas. The physical activity aspect of the curriculum lends itself perfectly to physical education classes. Health and family and consumer science classes could incorporate more nutrition topics, including additional food tastings and demonstrations. Science classes could integrate gardening, as well as units on digestion and metabolism. Language arts classes could provide students with time to write about and discuss their experiences with nutrition, fitness, and food. The collaboration among teachers and classes allows students to experience the inter-

connectedness of food, nutrition, and wellness with everything they are learning in school.

Future longitudinal research is needed on the integration of nutrition and fitness concepts into core-subject classes. Results should focus on nutrition and fitness knowledge acquisition, nutrition and fitness behavior changes, and core-subject knowledge achievement.

Conclusion

Food is an essential aspect of everyone's life. Humans need it for their survival. However, it is so much more than a simple, life-sustaining substance. We use food to socialize: celebrate, nurture, comfort, and mourn. Therefore, it makes practical sense to integrate teaching students how to eat healthfully and take care of their bodies into classes at school. This project demonstrates that nutrition and fitness can successfully be integrated into math classes—but it does not need to stop there. Science, social studies, and language arts also could accommodate nutrition and fitness themes. School administrators can use this information to encourage collaboration among their teachers in these areas so that students can learn practical, real-life lessons within the academic curriculum.

Results of the Wellness Integrated Mathematics Intervention indicate that a 4-week, standards-based mathematics curriculum integrating nutrition and fitness can be an effective way to teach proportional reasoning while also increasing nutrition and fitness knowledge. Knowledge in three subjects (math, nutrition, and fitness) was gained in the intervention group, but only math knowledge was gained in the comparison group. This result has practical meaning today as schools are struggling financially and cutting non-

core classes such as health and physical education. The WIM Intervention demonstrates that core and non-core subjects can successfully be integrated while not compromising the acquisition of core-subject knowledge.

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APPENDIX A

NUTRITION AND FITNESS PROGRAMS FOR CHILDREN

Nutrition and Fitness Programs for Children

Experiment and/or Intervention Name	Experiment Design	Components of Intervention	Number and Grade of Participants	Theory Used for Intervention Design	Subject Integration	Length & Descriptions of Interventions	Intervention Results
Michigan Model: "What's Food Got To Do With It?"	Pre/post-test quasi-experimental design	Classroom	783 middle school students	Not Specified	Health	8 Lessons 8-10 hours	Increased nutrition knowledge Increase confidence in eating healthfully Positive nutrition behavior changes
Choice, Control and Change:	Pre/post-test evaluation design	Classroom	278 middle school students	The Theory of Planned Behavior	Science	24 Lessons	Among others: Increased fruit and vegetable intake Reduced sedentary activities
Eat Well and Keep Moving	quasi-experimental design using repeated 24-hour diet recalls and repeated cross-sectional surveys	Classroom Parent Cafeteria	479 initially 4 th grade students	Social Cognitive Theory Social Marketing	Science Social Studies Language Arts Math	26-36 50 minute lessons over 2 years	Increased nutrition and physical activity knowledge Improved dietary intake Reduced television viewing
MI: Minimal Intervention	Pre/post-test randomized (at the school level)	Classroom	551 Teenagers	Not Specified	Health	Two 30 minute PowerPoint presentations	Improved nutrition knowledge Increased positive behavioral intentions
Planet Health	Pre-post-test, randomized (at the school level)	Classroom	1295 6 th -8 th grade students	Social Cognitive Theory	Science Social Studies Language Arts Math Physical Ed	32 Lessons over 2 years	Among others: Reduced prevalence of obesity and increased fruit and vegetable consumption among girls
High 5	Pre/post-test (at 1 and 2 years post intervention) randomized (at the school level)	Classroom Parent Cafeteria	1,698 families of 4 th grade students	Social Cognitive Theory	NA – This was strictly a nutrition curriculum	14 Lessons (30-45 min) Plus 3 booster Lessons Parent Kick-Off Night Cafeterias offer at least 10 fruit and vegetable servings per week.	Increased nutrition knowledge Increased fruit and vegetable consumption
EatFit	Pilot pre/post-test design	Classroom	34 middle school students	Social Cognitive Theory	NA – This was strictly a nutrition /physical activity curriculum	9 Lessons	Among other: Positive dietary behavior changes Positive physical activity behavior changes Increased self-efficacy

APPENDIX B

COMPONENTS OF SOCIAL COGNITIVE THEORY USED IN THE EATFIT CURRICULUM

Components of Social Cognitive Theory used in the EatFit Curriculum

Tenant	Example of how each tenant is used in EatFit
Social Support	Students were placed in groups according to their nutrition and physical activity goals,
Self-Efficacy	Food tastings, food preparation demonstrations, and physical activity practice gave students confidence to perform these activities on their own.
Outcome Expectancies	Through focus groups with 11-15 year olds, EatFit found that improved appearance, increased energy, and increased independence were the outcomes most important to this age group.
Self-Regulation	Goal setting, self-monitoring, barrier counseling, and rewards were used to encourage students to stay on track.

APPENDIX C

COMPONENTS OF SOCIAL COGNITIVE THEORY IN WELLNESS INTEGRATED MATHEMATICS (WIM)

Components of Social Cognitive Theory used in the WIM Curriculum

Construct/Possible Mediator of Behavior Change	Application in the WIM Curriculum
Outcome Expectations (What are the benefits of changing behavior?)	Lesson 1: Students answered questions such as: “What does it mean to be healthy?” and “Why should I choose to eat healthfully?” Lessons 6 & 8: Students learned about specific nutrients and their role keeping the body healthy.
Outcome Expectancies (What outcomes are most important to given participants?)	Through focus groups with 11-15 year olds, EatFit found that improved appearance, increased energy, and increased independence were the outcomes most important to this age group. Therefore, WIM focuses on these three outcomes in lessons 1, 4, 6, and 9.
Behavioral Capability (What knowledge and skills are needed to make change?)	Participants gained nutrition or fitness knowledge and math knowledge in every lesson of the WIM intervention. The following lessons taught specific nutrition/fitness skills: Lesson 2: How to estimate portion sizes. Lesson 3: How to enter a diet log into government database. Lesson 5: How to determine and find one’s heart rate. Lesson 6: How to read a food label. Lesson 9: How to follow a recipe as well as increase or decrease the specific number of servings.
Observational Learning/Modeling (What do the participants need to see or do to be successful?)	Lesson 4: How to perform specific exercises. Lesson 9: How to make hummus.
Self-Efficacy (How confident are the participants in performing new skill?)	Students practiced their exercise skills, food label reading skills, recipe-tailoring skills, and math skills throughout the WIM intervention.
Reinforcements (What intrinsic or extrinsic motivators exist?)	The intrinsic motivators of improved appearance, increased energy, and increased independence were woven throughout WIM and especially seen in lessons 1, 4, 6, and 9.
Self-Regulation/Self-Control (Did the students set goals and monitor their progress?)	Lesson 3: Nutrition goal setting and solutions for possible barriers to achieving those goals. Lesson 4: Fitness goal setting and solutions for possible barriers to achieving those goals. Goal tracking throughout the intervention.

APPENDIX D

WELLNESS INTEGRATED MATHEMATICS CURRICULUM

WELLNESS INTEGRATED MATHEMATICS
(WIM) CURRICULUM

Jody Swigris

Lesson 1 – Teacher Notes:

- 1) Teacher asks students first question, “What does it mean to eat healthfully?”
- 2) Students write answers on sticky notes and place them on the board in the front of the room.
- 3) Students and teacher group similar answers and select the top 4 answers (those answered most often).
- 4) Students create a bar graph using this data.
- 5) Students learn how to use proportion and a protractor to create a pie graph to represent this data.
- 6) Students are asked the remaining three questions.
- 7) Again, answers are written on sticky notes, placed on the board and grouped.
- 8) Students are placed into three different groups. Each groups creates a bar graph and pie chart to represent one of the three questions.

Wellness Integrated Mathematics – Lesson 1

1) What does it mean to eat healthfully?

a) Write your answer below and on the sticky note provided.

b) After organizing our sticky notes on the board, what were the class' top four descriptions for eating healthfully?

- _____ = _____ people = _____ %
- _____ = _____ people = _____ %
- _____ = _____ people = _____ %
- _____ = _____ people = _____ %
- (Other) _____ = _____ people = _____ %

c) Organize this data into a bar graph.

d) Organize the same data into a pie graph. Use proportions to figure out the correct degree measures for each sector of the circle. Use a protractor to accurately measure the angles.

- _____ = _____ people = _____ % = _____ °
 $\frac{360^\circ}{100\%} = \frac{\quad}{\quad}$
- _____ = _____ people = _____ % = _____ °
- _____ = _____ people = _____ % = _____ °
- _____ = _____ people = _____ % = _____ °
- (Other) _____ = _____ people = _____ % = _____ °

2) Why should I choose to eat healthfully?

- a) Write your answer below and on the sticky note provided.
- b) After organizing our sticky notes on the board, what were the class' top four reasons for eating healthfully?

- _____ = _____ people = _____ %
- _____ = _____ people = _____ %
- _____ = _____ people = _____ %
- _____ = _____ people = _____ %
- (Other) _____ = _____ people = _____ %

3) What does it mean to be physically fit?

a) Write your answer below and on the sticky note provided.

b) After organizing our sticky notes on the board, what were the class' top four descriptions of being physically fit?

- _____ = _____ people = _____ %
- _____ = _____ people = _____ %
- _____ = _____ people = _____ %
- _____ = _____ people = _____ %
- (Other) _____ = _____ people = _____ %

4) Why should I choose to be physically fit?

a) Write your answer below and on the sticky note provided.

b) After organizing our sticky notes on the board, what were the class' top four reasons for being physically fit?

- _____ = _____ people = _____ %
- _____ = _____ people = _____ %
- _____ = _____ people = _____ %
- _____ = _____ people = _____ %

5) Create a bar graph and a pie chart to represent the data our class collected for one of the previous questions. Use proportion and a protractor for the pie chart.

Groups 1, 2 and 3:	Question 2
Groups 4, 5 and 6:	Question 3
Groups 7, 8, 9 and 10:	Question 4

Write your question here:

Bar Graph:

Pie Chart:

Lesson 2 – Teacher Notes:

- 1) **3-D Models:** Food models from the nutrition center will be used to show examples of serving size. Students will estimate the serving size of each food. The correct serving size will be discussed as a class
- 2) **Practice Diet Log:** This worksheet will be completed as a classroom activity. The activity serves as practice for students to accurately complete their 24-hour diet log. The teacher will ask students to volunteer a typical breakfast, snack, lunch, etc. The teacher will lead a class discussion to determine where to place volunteered foods and amounts in the log.
- 3) **24-Hour Diet Log:** This will be completed as homework and will be confidential. Students will be reminded that no one except for the research team will ever see their diet logs and their names will never be used in the research paper or presentation.

Wellness Integrated Mathematics Lesson 2

There are several food models set up around the room. Estimate how much food is represented by each model.

- 1) Apple Sauce
 - a) $\frac{1}{4}$ cup
 - b) $\frac{1}{2}$ cup
 - c) 1 cup
 - d) $1\frac{1}{2}$ cups

- 2) Broccoli
 - a) $\frac{1}{4}$ cup
 - b) $\frac{1}{2}$ cup
 - c) 1 cup
 - d) $1\frac{1}{2}$ cups

- 3) Chicken Breast
 - a) 2 ounces
 - b) 3 ounces
 - c) 4 ounces
 - d) 5 ounces

- 4) Hamburger
 - a) 2 ounces
 - b) 3 ounces
 - c) 4 ounces
 - d) 5 ounces

- 5) Bread
 - a) 1 ounce
 - b) 2 ounces
 - c) 3 ounces
 - d) 4 ounces

- 6) Cheese
 - a) 1 ounce
 - b) 2 ounces
 - c) 3 ounces
 - d) 4 ounces

- 7) Milk
- a) $\frac{1}{4}$ cup
 - b) $\frac{1}{2}$ cup
 - c) 1 cup
 - d) $1\frac{1}{2}$ cups
- 8) Strawberries
- a) $\frac{1}{4}$ cup
 - b) $\frac{1}{2}$ cup
 - c) 1 cup
 - d) $1\frac{1}{2}$ cups
- 9) Pears
- a) $\frac{1}{4}$ cup
 - b) $\frac{1}{2}$ cup
 - c) 1 cup
 - d) $1\frac{1}{2}$ cups
- 10) Peanut Butter
- a) 1 Teaspoon
 - b) 1 Tablespoon
 - c) 2 Tablespoons
 - d) 3 Tablespoons
- 11) Butter
- a) 1 Teaspoon
 - b) 1 Tablespoon
 - c) 2 Tablespoons
 - d) 3 Tablespoons
- 12) Bagel
- a) 1 ounce
 - b) 2 ounces
 - c) 3 ounces
 - d) 4 ounces
- 13) Angel Food Cake
- a) 1 ounce
 - b) 2 ounces
 - c) 3 ounces
 - d) 4 ounces

How Much am I Eating?

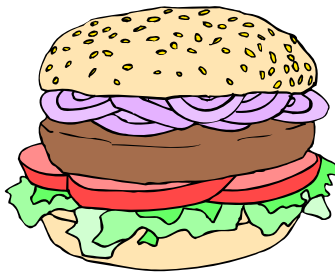
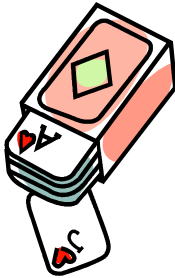
- 1 cup is about the size of a baseball.



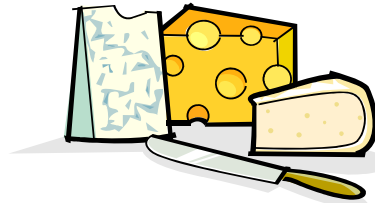
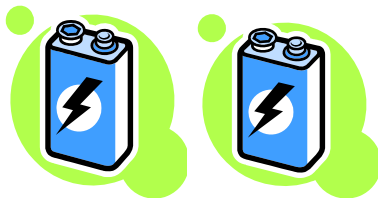
- $\frac{1}{2}$ cup is about the size of an ice cream scoop.



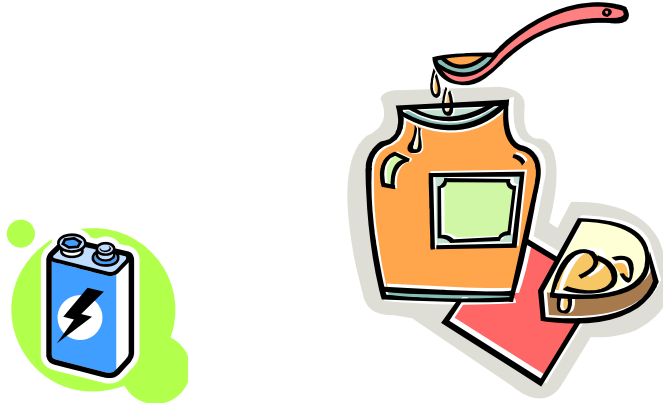
- 3 ounces of meat is about the size of a deck of cards.



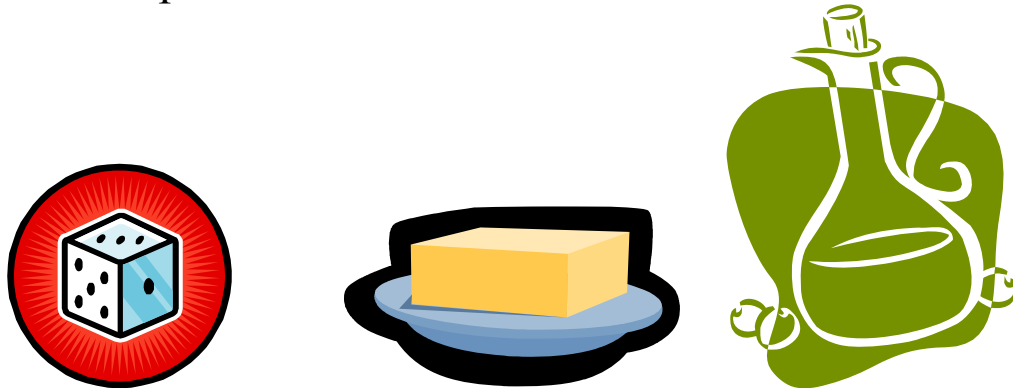
- 1.5 ounces of cheese is about the size of two 9-volt batteries.



- 1 tablespoon is about the size of a 9-volt battery.



- 1 teaspoon is about the size of 1 die.



- 1 cup of milk/juice is an 8-ounce carton of milk/juice.



When filling out your diet log, please write down the amount of food you eat.

Food Group	Your Intake
Fruit (cups)	<ul style="list-style-type: none"> • 1 cup is about the size of your fist • 1 cup = 1 medium banana • 1 cup = 1 medium apple • 1 cup = 8 large strawberries • 1 cup fresh = ½ cup dried (raisins)
Vegetables (cups)	<ul style="list-style-type: none"> • 1 cup is about the size of your fist • 1 cup = 2 medium carrots • 1 cup = 1 large ear of corn • 1 cup = 1 large tomato • 1 cup = 1 large pepper • 1 cup = 1 medium potato
Milk (cup equivalents)	<ul style="list-style-type: none"> • 1 cup equivalent = 1 cup milk • 1 cup equivalent = 1 cup of yogurt • 1 cup equivalent = 1 oz cheese, about 1/3 cup shredded cheese • cup equivalent = 1 oz cheese, about 1 square inch of cheese • 1 cup equivalent = ½ cup cottage cheese • 1 cup equivalent = 1 cup pudding made with milk
Meat/Beans (ounces)	<ul style="list-style-type: none"> • 1 oz = 1 egg • 1 oz = ¼ cup cooked beans • 2 oz peanut butter = about the size of a ping pong ball • 3 oz meat, fish or poultry = about the size of a deck of cards
Grains (ounces)	<ul style="list-style-type: none"> • 1 oz = 1 slice of bread • 1 oz = 1 cup of breakfast cereal • 1 oz = ½ cup cooked rice, oatmeal, or pasta • 1 oz = 1 small tortilla
Fats (teaspoons)	<ul style="list-style-type: none"> • 1 tsp of butter or margarine = about the size of 1 dice • 1 tsp oil = about a quarter in diameter

Name: _____ Period: _____ ID Number: _____

24-Hour Diet Log:

Meal	What I ate	How much of each food I ate
Breakfast		
Snack		
Lunch		
Snack		
Dinner		
Snack		

Lesson 3 – Teacher Notes:

- 1) Students enter their 24-hour diet log into the *MyPyramid* database.
- 2) Students assess their nutrition intake by going to *MyPyramid Recommendations*. This page shows the students how their daily intake of milk, meat/beans, vegetables, fruit, and grains compares to the recommended daily intake.
- 3) Students calculate their daily intake as a percentage of the recommended daily intake for each nutrient by using proportions.
- 4) Teacher leads class discussion regarding how to make better nutritional choices for meals, beverages, and snacks.
- 5) They then use a centimeter ruler to create a percent graph representing their daily intake compared to the recommended daily intake for each nutrient.
- 6) For homework, they determine individual nutrition goals for each nutrient.
- 7) Each student chooses one primary nutrition goal specific to their own needs.
- 8) They brainstorm ways to achieve their goal, along with obstacles that may hinder their progress, and solutions to these problems.
- 9) The following class, the students will receive a *Nutrition Goal Tracking Sheet*. For the next two weeks, they will keep track of their daily progress by using the sheet.

Wellness Integrated Mathematics – Lesson 3

- Fill out a cover page for this assignment.
- Enter you 24-hour diet log into the *MyPyramid* database.
- Assess your nutrition intake by going to *MyPyramid Recommendations*.
- Print two copies of the recommendation page. Keep one copy and give the other to Ms. Swigris. Make sure your cover page is stapled to the copy you hand in.

1) **Milk**

- a) My milk intake = _____ cups.
- b) My milk recommendation = _____ cups.
- c) Set up a proportion to calculate the percent of recommended milk you are getting.

$$\underline{\hspace{2cm}} = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}\%$$

- d) Use a centimeter ruler to accurately fill in the percent graph to the right

2) **Meat/Beans**

- a) My meat/bean intake = _____ ounces.
- b) My meat/bean recommendation = _____ ounces.
- c) Set up a proportion to calculate the percent of recommended meat/beans you are getting.

$$\underline{\hspace{2cm}} = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}\%$$

- d) Use a centimeter ruler to accurately fill in the percent graph to the right

3) Vegetables

- a) My vegetable intake = _____ cups.
- b) My vegetable recommendation = _____ cups.
- c) Set up a proportion to calculate the percent of recommended vegetables you are getting.

$$\underline{\hspace{2cm}} = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}\%$$

- d) Use a centimeter ruler to accurately fill in the percent graph to the right

4) Fruit

- a) My fruit intake = _____ cups.
- b) My fruit recommendation = _____ cups.
- c) Set up a proportion to calculate the percent of recommended fruit you are getting.

$$\underline{\hspace{2cm}} = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}\%$$

- d) Use a centimeter ruler to accurately fill in the percent graph to the right

5) Grains

- a) My grain intake = _____ ounces.
- b) My grain recommendation = _____ ounces.
- c) Set up a proportion to calculate the percent of recommended grains you are getting.

$$\underline{\hspace{2cm}} = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}\%$$

- d) Use a centimeter ruler to accurately fill in the percent graph to the right

Nutrition Goals (Homework):

1) Milk Goal:

- I am getting _____% of the recommended amount of milk.
- I need to increase/decrease my milk consumption by _____ cups.
- I could do this by:

2) Meat/Beans Goal:

- I am getting _____% of the recommended amount of meat/beans.
- I need to increase/decrease my meat/bean consumption by _____ ounces.
- I could do this by:

3) Vegetable Goal:

- I am getting _____% of the recommended amount of vegetables.
- I need to increase my vegetable consumption by _____ cups.
- I could do this by:

4) Fruit Goal:

- I am getting _____% of the recommended amount of fruit.
- I need to increase my fruit consumption by _____ cups.
- I could do this by:

5) Grains Goal:

- I am getting _____% of the recommended amount of grains.
- I need to increase/decrease my grain consumption by _____ ounces.
- I could do this by:

Wellness Integrated Mathematics – Lesson 3

Two Week Nutrition Goal Tracking Sheet:

1) What is your primary nutrition goal?
Track your primary goal each day.

2) If you achieved your goal, color in
the appropriate row.

3) At the end of two weeks, determine
what percent of the graph is
colored. Use a proportion. Show
your work below.

4) Were you successful at achieving
your primary nutrition goal?

Day 14 (/ /09)
Day 13 (/ /09)
Day 12 (/ /09)
Day 11 (/ /09)
Day 10 (/ /09)
Day 9 (/ /09)
Day 8 (/ /09)
Day 7 (/ /09)
Day 6 (/ /09)
Day 5 (/ /09)
Day 4 (/ /09)
Day 3 (/ /09)
Day 2 (/ /09)
Day 1 (/ /09)

Lesson 4 - Teacher Notes:

- 1) Students will fill out a survey asking them how much time they spent the previous week doing aerobic exercise, strength training exercises, stretching exercises, and life-style activities.
- 2) A fitness expert will be a guest speaker during this class. She will describe the importance of each of the above-mentioned exercises and how many minutes each week should be spent doing each.
- 3) The fitness expert will demonstrate flexibility/stretching exercises, strength training exercises, and aerobic exercises during class.
- 4) Students will practice the above-mentioned exercises during class.
- 5) Students will then determine individual fitness goals.
- 6) Expert will lead students in discussing possible barriers that may stand in the way of them achieving their goals as well as possible solutions.
- 7) The following class, the students will receive a *Fitness Goal Tracking Sheet*. For the next two weeks, they will keep track of their weekly progress by using the sheet.

Wellness Integrated Mathematics – Lesson 4

1) Aerobic Activity

a) Last week, how many minutes did you spend:

- Biking, speed walking, or jogging? _____ minutes
- Dancing, do aerobics, cheerleading or doing other fun movements? _____ minutes
- Skateboarding, rollerblading or riding a scooter? _____ minutes
- Playing soccer, football, volleyball, basketball...? _____ minutes
- Doing water or snow sports like swimming, sledding or skiing? _____ minutes
- Doing martial arts? _____ minutes
- Doing any other aerobic activity? _____ minutes

Total = _____ minutes

b) The current recommendation for aerobic activity is about _____ minutes per day. That's about _____ minutes per week.

c) Do you meet the current weekly recommendation for aerobic activity? What percent of the recommended minutes did you accomplish last week? Use a proportion. Show your work.

2) Strength Training

a) Last week, how many minutes did you spend:

- Lifting weights? _____ minutes
- Doing push-ups or sit-ups? _____ minutes
- Doing other strengthening exercises? _____ minutes

Total = _____ minutes

b) Our community expert's recommendation for strength training is about _____ minutes per week.

c) Do you meet the current weekly recommendation for strength training? What percent of the recommended minutes did you accomplish last week? Use a proportion. Show your work.

3) Stretching

a) Last week, how many minutes did you spend:

- Stretching, including P.E class or sports practice? _____ minutes
- Doing yoga or stretching class? _____ minutes
- Doing other stretching exercises? _____ minutes

Total = _____ minutes

b) Our community expert’s recommendation for stretching is about _____ minutes per week.

c) Do you meet the current weekly recommendation for stretching?
What percent of the recommended minutes did you accomplish last week? Use a proportion. Show your work.

4) Lifestyle Activities

You can also keep fit by incorporating the following lifestyle activities into your weekly schedule:

- Climbing stairs instead of taking the elevator.
- Finding a “far” parking spot.
- Walking to a friend’s house or the store instead of driving.
- Playing pool, Frisbee, ping pong or other recreational activities.
- Walking or riding your bike to school.
- Washing the car, doing housework, yard work or other mildly active work.

Fitness Goal Setting

1) **Aerobic exercise** is great for many reasons including:

-
-
-

Do you want your fitness goal to be to increase your aerobic activity? If so,

- Choose an activity: aerobics, bicycling, dancing, field sports, in-line skating, jogging, martial arts, rowing, running, skateboarding, snow sports, stair climbing, swimming, fast walking, other _____.
- Choose how long: 30 minutes, 40 minutes, 50 minutes, 60 minutes.
- Choose how often: 2 days a week, 3 days a week, 4 days a week, 5 days a week, 6 days a week, every day.
- Write down your goal: I will do _____ for _____ minutes, _____ days a week for the next two weeks.
- Be specific! What days will you do this and what time?

2) **Strength training** is important for many reasons including:

-
-
-

Do you want your fitness goal to be to increase your strength training? If so,

- Choose an activity: push-ups, sit-ups, lunges, squats, triceps dips other _____.
- Choose how many: 15, 20, 30, 40, 50.
- Choose how often: 2 days a week, 3 days a week, 4 days a week.
- Write down your goal: I will do _____ (how many) _____ (exercise) _____ days a week for the next two weeks.
- Be specific! What days will you do this and what time?

3) **Stretching** can help your body in many ways including:

-
-
-

Do you want your fitness goal to be to increase your weekly stretching? If so,

- Choose a body part: neck and shoulders, arms, legs, torso.
- Choose how long: 2 minutes, 3 minutes, 4 minutes, 5 minutes.
- Choose how often: 2 days a week, 3 days a week, 4 days a week.
- Write down your goal: I will stretch _____ for _____ minutes, _____ days a week for the next two weeks.
- Be specific! What days will you do this and what time?

4) It's easy to incorporate more **lifestyle activities** into your weekly schedule. Do you want your fitness goal to be to increase your lifestyle activities? If so, choose one of the following goals:

- Walk or bicycle to school at least twice a week and take the stairs whenever possible.
- Watch TV/play video games/computer less than 1 hour a day.
- Participate in active leisure activities (frisbee, ping pong, bowling...) at least twice a week.
- Walk the dog at least twice a week and walk instead of drive whenever possible.
- Do housework or yard work at least twice a week.
- Other: _____.

Be specific! What days will you do this and what time?

5) Now, brainstorm potential obstacles that could get in the way of you accomplishing your fitness goal. Think of possible solutions to these obstacles.

Wellness Integrated Mathematics – Lesson 4

Two Week Fitness Goal Tracking Sheet:

- 1) What is your primary fitness goal?
Track your fitness goal each week.

- 2) According to your personalized goal, how many days should you perform your fitness activity? For example, if you are going to stretch you legs four days a week, you will only use $4(\text{days}) \times 2(\text{weeks}) = 8$ days total for your fitness goal. You would cross out days 9 to 14. Figure out how many days you will use and cross out the extras.

- 3) If you achieved your goal, color in the appropriate day.

- 4) At the end of two weeks, determine what percent of the graph is colored. Use a proportion. Show your work below.

Day 14 (/ /09)
Day 13 (/ /09)
Day 12 (/ /09)
Day 11 (/ /09)
Day 10 (/ /09)
Day 9 (/ /09)
Day 8 (/ /09)
Day 7 (/ /09)
Day 6 (/ /09)
Day 5 (/ /09)
Day 4 (/ /09)
Day 3 (/ /09)
Day 2 (/ /09)
Day 1 (/ /09)

- 5) How successful were you at achieving your fitness goal?

Lesson 5 – Teacher Notes:

- 1) Students will determine their heart rate while performing various activities.
- 2) They will learn how many calories can be burned doing certain activities.
- 3) They will compare how long it takes to metabolize specific foods while doing different activities.

Wellness Integrated Mathematics – Lesson 5

- 1) How are eating and activity related? Circle the correct answer.
- a) They're not.
 - b) The food you eat is fuel you use to move.
 - c) The more protein you eat, the more weight you can lift.
 - d) Don't move for 20 minutes after eating.
- 2) Weight gain occurs when:
- a) Energy in (food) is less than energy out (activity).
 - b) Energy in (food) is equal to energy out (activity).
 - c) Energy in (food) is greater than energy out (activity).
 - d) They are not related.
 - e) I don't know.
- 3) What is your heart rate?
- a) Heart rate is measured in _____ (bpm).
 - b) The harder the activity, the _____ your heart beats.
 - c) Calculate your heart rate for the following activities by first measuring the beats in 10 seconds:

Activity	Beats in 10 Seconds	Beats per Minute
Sitting		
Standing		
Stretching		
Walking		
Strength Training		
Jogging		
Jumping Jacks		
Sprinting		

3) Counting Calories.

- a) The higher your heart rate, the _____ calories you burn.
b) Complete the following table for each activity listed

Activity	Calories Burned per 1 Minute	Calories Burned per 30 Minutes	Calories Burned per Week (30 min/day for 7 days)
Sitting	1.1		
Standing	1.4		
Stretching	3		
Walking	4		
Strength Training	5.3		
Jogging	7		
Jumping Jacks	10		
Sprinting	15		

- 4) The average teenage girl requires approximately _____ calories per day.
5) The average teenage boy requires approximately _____ calories per day.
6) The amount of calories you need depends on _____.

5) Calorie Payoff.

- a) What is your fitness goal?

To _____, for _____ minutes, _____ times a week.

- b) Here are the numbers of calories burned per minute for each fitness goal:

- Aerobic = 7
- Stretching = 3
- Strength Training = 5.3
- Lifestyle = 3.5

- c) Using the number that corresponds to your fitness goal, determine how long (in minutes and hours) it would take to metabolize (burn up) the foods listed below.

Food	Calories	Watching TV (1.1 cal/min)	Your Fitness Goal (_____ cal/min)
3.5 oz Bag of Chips	560		
3.5 oz Bag of Pretzels	385		
32 oz Soda	400		
32 oz Juice Spritzer (8 oz OJ + 24 oz Water)	112		
1 T Mayonnaise	99		
1 T Mustard	25		
Super Size Fries	450		
Small Fries	210		

Use Proportions!! Show your work. Use another piece of paper to show your work.

How long would it take to metabolize the chips by watching TV?

$$\frac{1.1 \text{ cal}}{1 \text{ min}} = \frac{560 \text{ cal}}{x \text{ min}}$$

How long would it take to metabolize the chips by performing your fitness goal?

$$\frac{\text{___ cal}}{1 \text{ min}} = \frac{560 \text{ cal}}{x \text{ min}}$$

Lesson 6: Teacher Notes:

- 1) The teacher will lead a class lesson on how to read and use a nutrition food label.
- 2) Students will take notes by filling in the blanks of their worksheet. During the lesson, they will perform mathematical calculations based on the information on the nutrition food label.
- 3) After the teacher-lead lesson, students will visit six *Food Label Facts Stations* set up around the room. Each station will display several food labels. Students will be asked to answer questions based on the food labels at the stations.

Wellness Integrated Mathematics
Lesson 6: Nutrition Facts Label

Nutrition Facts			
Serving Size 1 cup (228g)			
Servings Per Container 2			
Amount Per Serving			
Calories 250	Calories from Fat 110		
% Daily Value*			
Total Fat 12g	18%		
Saturated Fat 3g	15%		
Trans Fat 1.5g			
Cholesterol 30mg	10%		
Sodium 470mg	20%		
Total Carbohydrate 31g	10%		
Dietary Fiber 0g	0%		
Sugars 5g			
Protein 5g			
Vitamin A	4%		
Vitamin C	2%		
Calcium	20%		
Iron	4%		
* Percent Daily Values are based on a diet of other people's secrets.			
* Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs:			
	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

- 1) **Serving Size** and **Servings per Container**: Be careful. A package often contains _____ serving. How many servings does this package contain? _____
- 2) **Calories**. Compare this number to the total number of calories you should have per day. How many calories in one serving of this food? _____. How many calories in this entire package? _____. If your recommended caloric intake is 2,000 per day, and you ate the entire package, what _____ percent of your daily calories would you have eaten? _____. (Use a proportion.)

- 3) **Calories from Fat.** This number should be _____% or less of total calories. For one serving from this package, how many calories are from fat? _____. What percent of calories is from fat? _____. (Use a proportion.) FYI: 1 gram of fat contains 9 calories.
- 4) **Recommended Number of Calories.** Calories measure _____ supplied by food. Carbohydrate, fat and protein supply calories, while water, vitamins and minerals do not. The average female adolescent requires approximately _____ to _____ calories per day, and a male adolescent requires approximately _____ to _____ calories per day. These numbers are averages and vary depending on age, sex, height, weight, activity level and genetics.
- 5) **Fat.** Saturated fat is found naturally in _____ products like _____ and _____. Unsaturated fat is found mostly in _____, seeds and some fruits like _____ and _____. Fats are extremely important for our health. They are the main component of _____. We should limit our total intake of fat to between _____ and _____ grams per day. Saturated fat should be limited to less than _____ grams per day because too much saturated fat in our diet can lead to _____. Our intake of trans fat should always be _____ grams per day. How much saturated fat does this entire package contain? _____.
- 6) **Cholesterol.** Cholesterol is a type of _____ found in _____ products such as _____, _____ and _____. Cholesterol is used by the body to make _____ and build _____. Although we need cholesterol, we should try to keep our cholesterol intake less than _____ mg per day. One serving from this package contains how many mg of cholesterol? _____.
- 7) **Sodium.** Sodium is _____ which is essential for many body processes. Too much salt, however, has been associated with _____. We should try to keep our sodium intake to less than _____ mg per day. Two servings from this package contain _____ mg of sodium. That is _____% of the recommended amount. (Use a proportion.)

- 8) **% Daily Value.** _____% or less means that a food is low in that nutrient. Aim for 5% or less for _____, _____ and _____. Based on the % Daily Value for saturated fat, cholesterol and sodium, is this food high in these nutrients? _____
- 9) **Total Carbohydrate.** Carbohydrate comes primarily from _____, _____ and _____. Carbohydrates break down into _____ (a simple sugar) during digestion. This sugar provides us with _____ to think and _____ move. We should get between _____ and _____ grams of carbohydrate each day. How much carbohydrate does this entire package contain? _____
FYI: 1 gram of carbohydrate contains 4 calories.
- 10) **Dietary Fiber.** Fiber is a non-digestible _____ found mostly in _____, _____, _____ and _____. Fiber helps keep our _____ system running smoothly. Research also shows that eating at least _____ grams of fiber each day can reduce the risk of _____ and some _____. How much fiber in one serving of this food? _____.
- 11) **% Daily Value.** _____% or more means the food is high in that nutrient. Aim for 20% or more for _____, and all the _____ and _____ listed on the food label. Based on the % Daily Value, is this food high in fiber? _____.
- 12) **Sugar.** If sugar or another word for sugar (glucose, fructose, high fructose corn syrup, maltose, dextrose...) is one of the first _____ ingredients on the label, you can assume much of the sugar listed on the Facts Label is _____ sugar. Sugar will give you a quick boost of _____, but it won't last. Aim to keep your added sugar intake to less than _____ grams per day.
- 13) **Protein.** Protein comes mainly from _____ products like _____ and _____ as well as _____ and some _____. Protein is considered the _____ of cells and is involved in all essential life functions. We should be getting between _____ and _____ grams (4.5 – 6.0 ounces) of protein each day. One serving of this product contains 12 grams of protein. 12 grams is what percent of 165 grams? _____. (Use a proportion.)
FYI: 1 gram of protein contains 4 calories.

- 14) This package contains 12 grams of protein. How many calories are from protein in one serving? Use a proportion.
- 15) **Vitamin A**. Vitamin A is necessary for healthy _____ and _____.
- 16) **Vitamin C**. Vitamin C strengthens the _____ system and is essential for _____ healing and preventing _____.
- 17) **Calcium**. Calcium had many important roles including maintaining healthy _____ and _____. It is also needed to keep our _____ pumping. _____ products are a good source of calcium.
- 18) **Iron**. Iron also has many functions. It is an essential part of _____, which is the part of _____ cells that carries _____ throughout our bodies. If you don't get enough of this mineral, you may feel _____.
- 19) **% Daily Value**. Remember, _____% or more means the food is high in that nutrient. Aim for 20% or more for all the _____ and _____ listed on the food label. Based on the % Daily Value, is this food high or low in each vitamin/mineral? _____
- 20) **Good Source**. This term means that one serving of a food contains at least _____% of the daily value of a particular nutrient. Is this food a good source of Vitamin A, Vitamin C, Calcium and Iron? _____
- 21) Remember, most food labels base their percent daily value on a _____ calorie diet.

Wellness Integrated Mathematics – Lesson 6: Nutrition Facts Label (Classroom Assignment)

Six *Food Label Facts Stations* are set up around the room. Use the labels to help you answer each question below.

Station 1 (Calcium):

- 1a) Cheddar & Sour Cream Chips are a good source of calcium. True or False.
- 1b) Fill in the chart.

Beverage	Total Fat (g)	% Daily Value of Calcium
Whole Milk		
Fat-Free Milk		
OJ + Calcium		

- 1c) Yogurt provides what percent of the daily value of calcium?
 - A. 5%
 - B. 20%
 - C. 30%

Station 2 (Fruit and Vegetables):

- 2a) The percent daily value of Vitamin A in one serving of carrots is 50%. True or False.
- 2b) Fill in the chart.

Beverage	% of Vitamin C	% of Vitamin A
Fruit Punch		
OJ		
V8		

- 2c) What is the percent of fruit juice in Fruitopia?
 - A. 100%
 - B. 25%
 - C. 10%

Station 3 (Iron):

- 3a) Wheaties cereal provides 45% of the daily value of iron. True or False.
- 3b) Fill in the chart.

Food	Total Fat (g)	% Daily Value of Iron
Lean Ground Beef		
Regular Ground Beef		

- 3c) Refried beans provide what percent of the daily value of iron?
 A. 0%
 B. 5%
 C. 10%

Station 4 (Sugar):

- 4a) Pretzels have more grams of sugar than cookies. True or False.
 4b) Fill in the chart.

Cereal	Apple Jacks	Wheaties	Cheerios	Cocoa Krispies
Sugar (g)				

- 4c) How many grams of sugar are in regular soda? 4d) Diet soda?
 A. 40g
 B. 0g
 C. 14g

Station 5 (Eating Habits):

- 5a) The serving size of baked chips is 5 ounces. True or False.
 5b) Fill in the chart.

Food	Total Fat (g)
Plain Hamburger	
Hamburger with mayo and cheese	

- 1c) You need 64 ounces of fluid in a day. How many bottles of water would that take?
 A. 2
 B. 3
 C. 4

Station 6 (Fat):

- 6a) Eating chicken without the skin saves 1 gram of fat. True or False.
 6b) Fill in the chart.

Condiment	Total Fat (g)	Calories
Mayonnaise		
Ketchup		
Mustard		

- 6c) Which has less fat?
 A. Canadian Bacon
 B. Pepperoni

Lesson 7 – Teacher Notes:

- 1) Students use a Macaroni and Cheese food label and proportions to determine the number of teaspoons of sugar, fat and salt are in that food.
- 2) Students then visualize the amount of sugar, fat and salt in that food by placing the accurate amount of real sugar, fat (Crisco) and salt on a plate.
- 3) Next, students are placed into groups. They use the same process as above to visualize the amount of sugar, fat and salt in different meals. The meals include a variety of fast food meals as well as well-balanced homemade meals.
- 4) The groups will display their creations for the entire class.

Sample label for
Macaroni & Cheese

Nutrition Facts		
Serving Size 1 cup (228g)		
Serving Per Container 2		
Amount Per Serving		
Calories 250	Calories from Fat 110	
% Daily Value*		
Total Fat 12g		18%
Saturated Fat 3g		15%
Cholesterol 30mg		10%
Sodium 470mg		20%
Total Carbohydrate 31g		10%
Dietary Fiber 0g		0%
Sugars 5g		
Protein 5g		
Vitamin A		4%
Vitamin C		2%
Calcium		20%
Iron		4%

*Percent Daily Values are based on a diet of 2,000 calories. Your Daily Values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Wellness Integrated Mathematics – Lesson 7
How much sugar, fat and salt is in your food?

1) Sugar (Carbohydrate)

- a) 1 gram weighs about the same as 1 raisin.
- b) 4 grams of carbohydrate = 1 teaspoon of sugar
- c) To find the number of teaspoons of sugar in a particular food, look on the Nutrition Facts Label.
 - First, find the Serving Size and Number of Servings in the package.
 - Second, decide how many servings you are going to eat or drink.
 - Third, find the number of grams of carbohydrate in 1 serving and adjust for how many servings you are going to consume.
 - Fourth, use a proportion to determine the number of teaspoons of sugar in the amount you are going to consume.

2) Fat (Total Fat)

- a) 5 grams of fat = 1 teaspoon of fat
- b) To find the number of teaspoons of fat in a particular food, look on the Nutrition Facts Label.
 - Find the number of grams of total fat in 1 serving and adjust for how many servings you are going to consume.
 - Use a proportion to determine the number of teaspoons of fat in the amount you are going to consume.

3) Sodium

- a) 2,300 mg of sodium = 1 teaspoon of salt
- b) To find the number of teaspoons of salt in a particular food, look on the Nutrition Facts Label.
 - Find the number of milligrams of sodium in 1 serving and adjust for how many servings you are going to consume.

 - Use a proportion to determine the number of teaspoons of salt in the amount you are going to consume.

Visualize Sugar, Fat and Salt:

Groups 1 and 8: Big Mac + Large Fry + Large Coke

Groups 2 and 9: Cheese Burger + Small Fry + Small Coke

Groups 3 and 10: Hamburger + 1% Low Fat Milk + Fruit and Yogurt Parfait

Group 4: Southwestern Salad w/ Crispy Chicken + Salad Dressing + Large Coke

Group 5: Southwestern Salad w/ Grilled Chicken + Salad Dressing + Small Coke

Group 6: 3 oz Roasted Chicken + Med Baked Potato w/ 1 tsp Butter + 1 Cup Sautéed Broccoli + 1 cup 1% Low Fat Milk

Group 7: 3 oz Grilled Salmon + $\frac{3}{4}$ Cup Rice Pilaf + 1.5 Cup Salad Greens w/ 1 Tbsp Vinaigrette + 1 Med OJ

Wellness Integrated Mathematics – Lesson 7: Food Chart

Food/Beverage	Calories	Total Fat (g)	Sodium (mg)	Carbohydrate (g)
Big Mac	540	29	1,040	45
Cheese Burger	300	12	750	33
Hamburger	250	9	520	31
McChicken	360	16	830	40
Large Fry	500	25	350	63
Small Fry	230	11	160	29
Southwestern Salad w/ Crispy Chicken	430	20	920	38
Southwestern Salad w/ Grilled Chicken	320	9	960	30
McD's Salad Dressing	100	6	340	11
Fruit and Yogurt Parfait	160	2	85	31
1% Low Fat Milk	100	2.5	125	12
Medium OJ	180	0	5	42
Large Coke	310	0	20	86
Small Coke	150	0	10	40
----- ----	----- --	----- ---	----- --	----- ---
3 oz Roasted Chicken	166	6.6	334	0
Med Baked Potato w/ 1 tsp Butter	148	4.2	366	26
1 Cup Sautéed Broccoli	162	11.8	546	13
3 oz Grilled Salmon	145	6.4	397	0
¾ Cup Rice Pilaf	193	5	585	33
1.5 Cup Green Salad w/ 1 Tbsp Vinagrette	85	7	210	6

Lesson 8 – Teacher Notes:

- 1) Students first learn about the nutritional value of an apple.
- 2) Next, each student will taste three different apple varieties and decide on their favorite.
- 3) They will write their favorite down on a sticky note and place it on the board.
- 4) They will use proportions to determine what percent of the class preferred each variety.
- 5) Finally, they will use proportions and a protractor to create a pie graph for the data.

- 10) What percent of our class liked Honey Crisp the best? Use a proportion to find the percent.
- 11) How many people liked Gala the best?
- 12) What percent of our class liked Gala the best? Use a proportion to find the percent.
- 13) Now we are going to make a Pie Chart to represent our apple data. Remember, there are _____ degrees in a circle.
- a) _____% liked Fuji the best. How many degrees of a circle represent this percentage? Use a proportion to find the degrees.
- b) _____% liked Honey Crisp the best. How many degrees of a circle represent this percentage? Use a proportion to find the degrees.
- a) _____% liked Gala the best. How many degrees of a circle represent this percentage? Use a proportion to find the degrees.
- 14) Use a protractor to measure the degrees that represent each apple variety. Make sure to label your pie chart.

Lesson 9 – Teacher Notes:

- 1) Students learn about the food, hummus, and its nutritional value.
- 2) Students will use proportions to adjust the recipe for a variety of servings.
- 3) They will learn how much Vitamin C, calcium, iron and sodium are in one serving of hummus.
- 4) Next, students will make the hummus, with the help of adults, by following the directions provided.
- 5) Finally, they will enjoy eating the hummus with fresh, raw vegetables.

Lesson 9: Healthy Hummus

(Recipe by Mollie Katzen from Moosewood Cookbook)

A tangy and delicious chick pea purée from the Middle East, Hummus is a perfect sandwich spread or dip for fresh vegetables. Preparation is super-quick if you use a food processor, but you can also do the mincing and mashing by hand. This recipe calls for 3 cups cooked chick peas. You can soak and cook dry ones, but canned work just as well. This recipe makes eight ½ cup servings.

- 2 medium garlic cloves, sliced
- ½ cup chopped parsley
- 2 scallions, chopped
- 3 cups cooked chick peas
(two 15 ½ oz cans)
- 6 Tbs. tahini
- 6 Tbs. fresh lemon juice
- ¾ tsp. salt
- cumin and cayenne to taste

- 1) Place garlic, parsley and scallions in a food processor or blender, and mince.
- 2) Add chick peas, tahini, lemon juice, and salt, and purée.
(Remember, you can also do this by hand.)
- 3) Season to taste with cumin and cayenne, if desired.
- 4) Dip sliced carrots, celery, broccoli, sweet peppers into the hummus and enjoy!

Information for 1 serving:

Calories	220
Protein	7.9 grams
Carbohydrate	21.4 grams
Fiber	6.4 grams
Total Fat	12.5 grams
Cholesterol	4.4 milligrams
Vitamin A	18.8 micrograms
Vitamin C	9.6 milligrams
Calcium	86.4 milligrams
Iron	2.8 milligrams
Sodium	420.5 milligrams

Math Questions:

- 1) This recipe makes 8 servings. You want to make 20 servings. Use proportions to find out how much of each ingredient you need.

- | | |
|--------------------------------------|--------------------------------|
| - _____ medium garlic cloves, sliced | - _____ Tbs. tahini |
| - _____ cup chopped parsley | - _____ Tbs. fresh lemon juice |
| - _____ scallions, chopped | - _____ tsp. salt |
| - _____ cups cooked chick peas | - cumin and cayenne to taste |

- 2) This recipe makes 8 servings. You want to make enough so that everyone in our class can have 1 serving. Use proportions to find out how much of each ingredient you need.

- | | |
|--------------------------------------|--------------------------------|
| - _____ medium garlic cloves, sliced | - _____ Tbs. tahini |
| - _____ cup chopped parsley | - _____ Tbs. fresh lemon juice |
| - _____ scallions, chopped | - _____ tsp. salt |
| - _____ cups cooked chick peas | - cumin and cayenne to taste |

- 3) We need about 60 milligrams of Vitamin C each day. 1 serving of hummus provides us with what percent of our daily Vitamin C requirement? Use proportions.

- 4) We need about 1,000 milligrams of Calcium each day. 1 serving of hummus provides us with what percent of our daily Calcium requirement? Use proportions.

- 5) We need about 18 milligrams of Iron each day. 1 serving of hummus provides us with what percent of our daily Iron requirement? Use proportions.
- 6) We should not have more than 2,400 milligrams of sodium in a day. 1 serving of hummus contains what percent of 2,400 milligrams? Use proportions.

APPENDIX E

STUDENT WRITTEN ASSENT FORMS

Student Assent Form – Intervention Group

Student Name: _____ Period: _____ ID Number: _____

Today you will be starting a four-week unit on ratios and proportions. These math concepts will be taught using nutrition and fitness examples. As you know, Ms. Swigris is getting her master’s degree at CSU. For her final project, she created a four-week curriculum called Wellness Integrated Mathematics (WIM).

She is going to teach you WIM and she will be giving you two pre-tests and two post-tests. The results of the pre-test will not affect your grade, but will count only as completion grades. The post-tests will serve as the unit assessments and will count towards your grade. In addition, she will be asking you to complete two 24-hour diet logs. The content of the diet logs will not be graded, but the log itself will count as a completion grade. She would like to use the results from the assessments and diet logs in her master’s project. If you do allow Ms. Swigris to use your results, your names will remain anonymous and will never be used in her paper or presentation. If you do not want Ms. Swigris to use your results in her project, your decision will not negatively affect your grade in this class.

If you will allow Ms. Swigris to use the results of your math pre-test and post-test in her project, please check the following box:

I, _____, allow Ms. Swigris to use my results in her thesis project. (Please print your name here.)

If you do not want Ms. Swigris to use the results of your math pre-test and post-test in her final project, please check the following box:

I, _____, do not want Ms. Swigris to use my results in her thesis project. (Please print your name here.)

Student Signature: _____ Date: _____

Student Assent Form – Comparison Group

Student Name: _____ Period: _____ ID Number: _____

Ms. Swigris, another 8th grade math teacher here at Webber, is getting her master’s degree at CSU. Ms. Swigris is integrating mathematics (specifically ratios and proportions) with nutrition for her thesis project.

Ms. Swigris would like to see if her class can learn the same mathematical concepts my class will learn using her approach. To do this, she is asking to use your pre-tests and post-tests after the ratios and proportions unit.

If you agree to allow Ms. Swigris to use your test results in her project, your names will remain anonymous and will never be used in her paper or presentation. If you do not want Ms. Swigris to use your results in her project, your decision will not negatively affect your grade in this class.

If you will allow Ms. Swigris to use the results of your math pre-test and post-test in her project, please check the following box:

I, _____, allow Ms. Swigris to use my results in her thesis project. (Please print your name here.)

If you do not want Ms. Swigris to use the results of your math pre-test and post-test in her final project, please check the following box:

I, _____, do not want Ms. Swigris to use my results in her thesis project. (Please print your name here.)

Student Signature: _____ Date: _____

APPENDIX F

PARENT WRITTEN CONSENT FORMS

Ms. Jody L. Swigris
8th Grade Math Teacher
Webber Junior High School
jswigris@psdschools.org
(970) 488-7800

January 5, 2009

Dear Parents/Guardians,

As most of you know, besides being your son or daughter's math teacher, I am also a graduate student at Colorado State University studying human nutrition. For my thesis project, I decided to integrate the two subjects I am most passionate about: mathematics and nutrition.

For the thesis project, I will be teaching your students a four-week unit on ratios and proportions using nutrition and fitness applications and examples. The unit will be taught from February 16th through March 13th as part of the students' normal class time. All homework, tests, quizzes and diet logs will be part of the students' normal class work and will count as normal grades. The students will not be missing any of the 8th grade curricula as I will be teaching the appropriate math standards relating to ratios and proportions. Actually, I believe the students will be gaining meaningful and practical information regarding their health as it relates to the world of mathematics.

I would like to use results from student pre-tests, post-tests and diet logs in my research. Of course, all results will remain anonymous. No names will ever be used in any of my papers or presentations. Allowing me to use this data in my research project is voluntary. A decision to not allow me to use the data will not affect a student's class status or grade in any way.

Students will also be given this information and I will be asking them permission to use their results as well. Please see attached student letter.

Thank you for your support in my research project.

Sincerely,

Jody L. Swigris

Please return this permission sheet to Ms. Swigris by January 16, 2009

If you will allow Ms. Swigris to use the results of your child's assessments and diet logs in her project, please check the following box:

I allow Ms. Swigris to use _____ results in her thesis project.
(please print child's name here.)

If you do not want Ms. Swigris to use the results of your child's assessments or diet logs in her final project, please check the following box:

I do not want Ms. Swigris to use _____ results in her thesis project.
(please print child's name here.)

Parent Signature: _____ Date: _____

Dear Parents/Guardians,

Jody Swigris, another 8th grade math teacher here at Webber, is also a graduate student at Colorado State University studying human nutrition. She is integrating mathematics (specifically ratios and proportions) with nutrition for her thesis project.

Ms. Swigris would like to see if her class can learn the same mathematical concepts my class will learn using her approach. To do this, she is asking to use my students' pre-tests and post-tests after the ratios and proportions unit.

Ms. Swigris would like to use the results from her classes and my classes in her thesis project and presentation. Of course, all results will remain anonymous. No names will ever be used in any of her papers or presentations.

Allowing Ms. Swigris to use this data in her research project is voluntary. A decision to not allow her to use the data will not affect a student's class status or grade in any way.

Students will also be given this information and I will be asking them permission to use their results as well. Please see attached student letter.

Thank you for your support in Ms. Swigris' research project. Projects like this benefit both students and teachers.

Sincerely,

Mrs. Gessaman

Please return this permission sheet to Mrs. Gessaman by January 13, 2009

If you will allow Ms. Swigris to use the results of your child's assessments and in her project, please check the following box:

I allow Ms. Swigris to use _____ results in her thesis project. (please print child's name here.)

If you do not want Ms. Swigris to use the results of your child's assessments in her final project, please check the following box:

I do not want Ms. Swigris to use _____ results in her thesis project. (please print child's name here.)

Parent Signature: _____ Date: _____

APPENDIX G

WELLNESS INTEGRATED MATHEMATIC-QUESTIONNAIRE

Nutrition Knowledge and Fitness Knowledge Sections of WIM-Q

10) Here are some questions about food. Please write one number in each space.

a) Match the following:

 4 Calcium

 1 Iron

 3 Fat

 2 Fruits & Veggies

1. If you don't get enough of this mineral, you may feel tired.
2. Contain fiber to help keep your digestive tract running smoothly.
3. This has the most calories per gram.
4. Dairy products are a good source of this mineral.

Please use the following food label to answer questions 10b) and 10c).

Nutrition Facts	
Serving Size 1 cup (228g)	
Servings Per Container 2	
Amount Per Serving	
Calories 250	Calories from Fat 110
% Daily Value*	
Total Fat 12g	18%
Saturated Fat 3g	15%
Trans Fat 3g	
Cholesterol 30mg	10%
Sodium 470mg	20%
Potassium 700mg	20%
Total Carbohydrate 31g	10%
Dietary Fiber 0g	0%
Sugars 5g	
Protein 5g	
Vitamin A	4%
Vitamin C	2%
Calcium	20%
Iron	4%
* Percent Daily Values are based on a diet of other people's misdeeds. Your Daily Values may be higher or lower depending on your calorie needs.	
	Calories: 2,000 2,500
Total Fat	Less than 65g 80g
Sat Fat	Less than 20g 25g
Cholesterol	Less than 300mg 300mg
Sodium	Less than 2,400mg 2,400mg
Total Carbohydrate	300g 375g
Dietary Fiber	25g 30g

b) What is the serving size of this food? **228 grams**

1. 228 grams
2. 2 per container
3. 250 calories
4. 456 grams
5. I don't know

- c) How many milligrams of sodium are in **two** serving of this food? **940**
1. 470
 2. 940
 3. 2,400
 4. 235
 5. I don't know
- d) Most teenagers should aim to eat about **3 cups** of vegetables each day.
1. 1 cup
 2. 2 cups
 3. 3 cups
 4. 4 cups
 5. I don't know
- e) Most teenagers should aim to drink **3** cups (or cup equivalents) of milk each day.
1. 2 cups
 2. 3 cups
 3. 4 cups
 4. 5 cups
 5. I don't know.
- f) Calories measure **energy** supplied by food.
1. fat
 2. energy
 3. vitamins
 4. minerals
 5. I don't know.
- g) The number of recommended calories one should consume each day depends on: **all of the above**
1. age and gender
 2. height and weight
 3. activity level
 4. genetics
 5. all of the above
 6. none of the above
 7. I don't know.

11) Here are some more questions about fitness. Please place one number in each space.

a) Match each type of activity with the corresponding examples:

<u> 2 </u> Aerobic activity	1. squats
<u> 4 </u> Lifestyle activity	2. jogging
<u> 1 </u> Strength activity	3. yoga
<u> 3 </u> Stretching activity	4. bowling

b) Which type of exercise tones your muscles? **Strength**

1. Aerobic
2. Lifestyle
3. Strength
4. Stretching
5. I don't know.

c) Most teenagers should do some kind of exercise:

Every day of the week

1. Once a week
2. 2-3 times a week
3. 4-5 times a week
4. Every day of the week
5. I don't know.

d) Lifestyle activities such as washing the car, doing housework, playing pool, playing Frisbee, playing ping pong or bowling count as exercise.

True

1. True
2. False

e) How are eating and activity related?

The food you eat is the fuel you need to move.

1. They're not.
2. The food you eat is the fuel you need to move.
3. The more protein you eat, the more weight you can lift.
4. Don't move for 20 minutes after eating.
5. I don't know.

- f) Weight gain occurs when:
Energy in (food) is greater than energy out (activity).
1. Energy in (food) is less than energy out (activity).
 2. Energy in (food) is equal to energy out (activity).
 3. Energy in (food) is greater than energy out (activity).
 4. They are not related.
 5. I don't know.
- g) Aerobic activity burns more calories than weight training. True
1. True
 2. False

APPENDIX H

RATIOS AND PROPORTIONS MATH EXAM

Ratios and Proportions Exam

Name: _____ Teacher's Name: _____

Period: _____ ID#: _____ Date: _____

1) Determine if each of the following problems is a ratio or a rate. Write each in simplest form and write each rate as a unit rate. Remember units!

a) In a class of 27 students, 15 are girls.
ratio (1 pt) - 9 students/5 girls (1 pt)

b) A car traveled 400 miles on 20 gallons of gas.
ratio (1 pt) - 20 miles/1 gallon (1 pt)

c) James earned \$50.00 in 4 hours.
rate (1 pt) - \$12.50/hour (1 pt)

2) Solve the following proportions. Show your work!

a) $\frac{x}{6} = \frac{5}{3}$ b) $\frac{25}{40} = \frac{10}{x}$ c) $\frac{5.25}{1} = \frac{210}{x}$
work (1 pt) $x = 10$ (1 pt) work (1 pt) $x = 16$ (1 pt) work (1 pt) $x = 40$ (1 pt)

3) For each problem, set up a proportion, then solve. Show your work!
Remember units!

a) 5 grams of fat = 1 teaspoon of fat. A Big Mac, large fry and McFlurry contain 75 grams of fat. How many teaspoons is this?
proportion (1 pt) work (1pt) 15 teaspoons (1 pt)

b) Aerobic exercise burns 7 calories each minute. Super-Size Fries are 450 calories. How long would you have to do aerobic exercise to burn off Super-Size Fries?
proportion (1 pt) work (1pt) 64 minutes (1 pt)

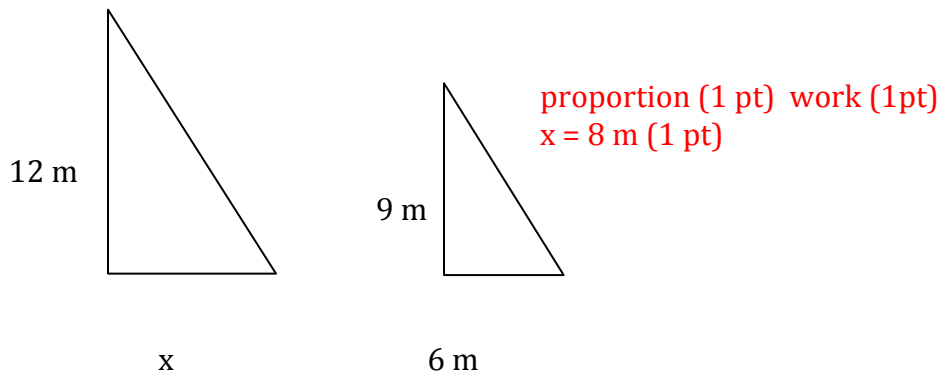
d) The ratio of flour to sugar in a cake recipe is 3 to 2. The recipe calls for 1 ½ cups of flour. How many cups of sugar are needed?
proportion (1 pt) work (1pt) 1 cup sugar (1 pt)

- e) 1 serving of bean dip contains 6.4 grams of fiber. How much fiber in 2.5 servings of bean dip?

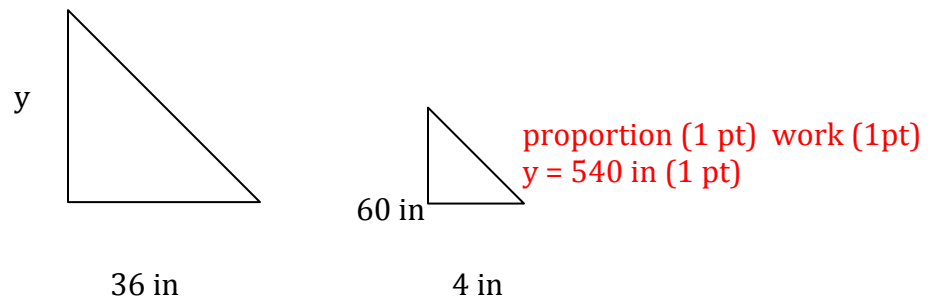
proportion (1 pt) work (1pt) 16 grams (1 pt)

- 4) For each problem, set up a proportion, then solve. Show your work. Remember units!

- a) Look at the similar figures below. Solve for x.



- b) A flagpole casts a shadow 36 inches long. A student who is 60 inches tall casts a shadow 4 inches long, how tall is the flagpole?



- 5) 30 students in an 8th grade class were asked, "What is your favorite sport?"

- 12 students said basketball.
- 4 students said baseball.
- 8 students said soccer.
- 6 students said volleyball.

- a) Use a proportion to determine what percent of students said basketball. Round to the nearest whole percent.

proportion (1 pt) work (1pt) 40% (1 pt)

- b) Use a proportion to determine what percent of students said baseball. Round to the nearest whole percent.

proportion (1 pt) work (1pt) 13% (1 pt)

- c) Use a proportion to determine what percent of students said soccer. Round to the nearest whole percent.

proportion (1 pt) work (1pt) 27% (1 pt)

- d) Use a proportion to determine what percent of students said volleyball. Round to the nearest whole percent.

proportion (1 pt) work (1pt) 20% (1 pt)

- 6) A group of 8th graders was asked, "What is your favorite fruit?"

- 15% of the groups said bananas.
- 55% of the group said grapes.
- 30% of the groups said apples.

If you wanted to create a pie chart to represent this data, you would need to know the number of degrees (of a circle) each percent represents. Use a proportion to determine the number of degrees each percent represents.

- a) 15% represents _____ degrees.

proportion (1 pt) work (1pt) 54 degrees (1 pt)

- b) 55% represents _____ degrees.

proportion (1 pt) work (1pt) 198 degrees (1 pt)

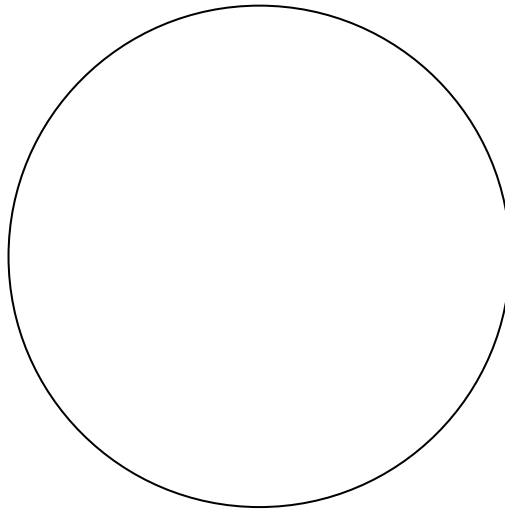
c) 30% represents _____ degrees.

proportion (1 pt) work (1pt) 108 degrees (1 pt)

7) Another survey asked students, "What is your favorite vegetable?" From the results, Jeff determined the percent and the number of degrees each percent represents. He found:

- 150 degrees represents tomatoes.
- 30 degrees represents broccoli.
- 110 degrees represents green beans.
- 70 degrees represents carrots.

Use your protractor to create a pie chart that represents this vegetable data.



APPENDIX I

NUTRITION PRE-TEST AND POST-TEST MEAN DIFFERENCES

BY QUESTION

Nutrition Pre-Test and Post-Test Mean Differences by Question

	n	M	SD	<i>t</i>	<i>p</i>	<i>d</i>
Question 10.a.1 (Dairy is a good source of calcium.)						
Intervention group				.000	1.000	.000
Pre-test	48	.94	.245			
Post-test	48	.94	.245			
Comparison group				-.903	.371	.148
Pre-test	47	.77	.428			
Post-test	47	.83	.380			
Question 10.a.2 (If you don't get enough iron, you may feel tired.)						
Intervention group				-1.520	.135	.264
Pre-test	48	.65	.483			
Post-test	48	.77	.425			
Comparison group				-.299	.767	.040
Pre-test	47	.55	.503			
Post-test	47	.57	.500			
Question 10.a.3 (Fat is the most caloric-dense micronutrient.)						
Intervention group				.375	.710	-.068
Pre-test	48	.92	.279			
Post-test	48	.90	.309			
Comparison group				-.496	.622	.101
Pre-test	47	.79	.414			
Post-test	47	.83	.380			
Question 10.a.4 (Fruits and vegetables contain fiber which is good for digestion.)						
Intervention group				-1.520	.135	.264
Pre-test	48	.65	.483			
Post-test	48	.77	.425			
Comparison group				-.299	.767	.040
Pre-test	47	.55	.503			
Post-test	47	.57	.500			
Question 10.b (Find the serving size on a given food label.)						
Intervention group				.000	1.000	.000
Pre-test	48	.77	.425			
Post-test	48	.77	.425			
Comparison group				-1.521	.135	.270
Pre-test	47	.57	.500			
Post-test	47	.70	.462			

Question 10.c (Find the amount of sodium in two servings using a food label.)

Intervention group				-1.151	.256	.234
Pre-test	48	.71	.459			
Post-test	48	.81	.394			
Comparison group				.000	1.000	.000
Pre-test	47	.53	.504			
Post-test	47	.53	.504			

Question 10.d (Most teenagers should aim to eat 3 cups of vegetables each day.)

Intervention group				-3.293	.002	.663
Pre-test	48	.31	.468			
Post-test	48	.63	.489			
Comparison group				.621	.537	-.119
Pre-test	47	.49	.505			
Post-test	47	.43	.500			

Question 10.e (Most teenagers should aim to drink 3 cups of milk each day.)

Intervention group				-4.497	.000	.886
Pre-test	48	.15	.353			
Post-test	48	.54	.50			
Comparison group				-.892	.377	.170
Pre-test	47	.28	.452			
Post-test	47	.36	.486			

Question 10.f (Calories measure energy supplied by food.)

Intervention group				-5.310	.000	.806
Pre-test	48	.29	.459			
Post-test	48	.67	.476			
Comparison group				-1.529	.133	.207
Pre-test	47	.30	.462			
Post-test	47	.40	.496			

Question 10.g (The number of calories a person needs each day depends on many factors.)

Intervention group				-2.067	.044	.360
Pre-test	48	.65	.483			
Post-test	48	.81	.394			
Comparison group				.703	.485	-.079
Pre-test	47	.57	.500			
Post-test	47	.53	.504			

APPENDIX J

FITNESS PRE-TEST AND POST-TEST MEAN DIFFERENCES

BY QUESTION

Fitness Pre-Test and Post-Test Mean Differences by Question

	n	M	SD	t	p	d
Question 11.a.1 (Squats are a type of strength training exercise.)						
Intervention group				-3.923	.000	.659
Pre-test	48	.44	.501			
Post-test	48	.75	.438			
Comparison group				-.942	.351	.182
Pre-test	47	.36	.486			
Post-test	47	.45	.503			
Question 11.a.2 (Jogging is an aerobic activity.)						
Intervention group				-1.430	.159	.204
Pre-test	48	.77	.425			
Post-test	48	.85	.357			
Comparison group				.496	.622	-.084
Pre-test	47	.68	.471			
Post-test	47	.64	.486			
Question 11.a.3 (Yoga involves stretching.)						
Intervention group				-4.134	.000	.741
Pre-test	48	.50	.505			
Post-test	48	.83	.377			
Comparison group				.000	1.000	.000
Pre-test	47	.55	.503			
Post-test	47	.55	.503			
Question 11.a.4 (Bowling is a lifestyle activity.)						
Intervention group				-2.480	.017	.458
Pre-test	48	.63	.489			
Post-test	48	.83	.377			
Comparison group				-.621	.537	.140
Pre-test	47	.53	.504			
Post-test	47	.60	.496			
Question 11.b (Strength exercises tone muscles.)						
Intervention group				-2.224	.031	.363
Pre-test	48	.65	.483			
Post-test	48	.81	.394			
Comparison group				-1.159	.252	.184
Pre-test	47	.34	.479			
Post-test	47	.43	.500			
Question 11.c (Most teenagers should exercise every day of the week.)						
Intervention group				-1.770	.083	.268
Pre-test	48	.31	.468			

Post-test	48	.44	.501			
Comparison group				-3.330	.743	.045
Pre-test	47	.26	.441			
Post-test	47	.28	.452			
Question 11.d (Lifestyle activities like gardening and housework count as exercise.)						
Intervention group				-3.066	.004	.573
Pre-test	48	.81	.394			
Post-test	48	.98	.144			
Comparison group				1.430	.160	-.202
Pre-test	47	.87	.377			
Post-test	47	.79	.414			
Question 11.e (The food you eat provides the fuel you need to move.)						
Intervention group				-1.273	.209	.254
Pre-test	48	.81	.394			
Post-test	48	.90	.309			
Comparison group				-.299	.767	.069
Pre-test	47	.74	.441			
Post-test	47	.77	.428			
Question 11.f (Weight gain occurs when “energy in” is greater than “energy out.”)						
Intervention group				-2.653	.011	.458
Pre-test	48	.63	.489			
Post-test	48	.83	.377			
Comparison group				-1.000	.323	.170
Pre-test	47	.64	.486			
Post-test	47	.72	.452			
Question 11.g (The higher your heart rate, the more calories you burn.)						
Intervention group				3.270	.002	-.685
Pre-test	48	.92	.279			
Post-test	48	.65	.483			
Comparison group				-.330	.743	.057
Pre-test	47	.85	.360			
Post-test	47	.87	.337			
Question 11.h (Aerobic activity burns more calories than weight training.)						
Intervention group				-3.362	.002	.625
Pre-test	48	.71	.459			
Post-test	48	.94	.245			
Comparison group				-1.273	.209	.219
Pre-test	47	.74	.441			
Post-test	47	.83	.380			

APPENDIX K

MATH PRE-TEST AND POST-TEST MEAN DIFFERENCES

BY SECTION

Math Exam Pre-test and Post-test Overall Mean Differences by Section

	n	M	SD	%	<i>t</i>	<i>p</i>	<i>d</i>
Section 1 (6 points: Differentiating between ratios and rates. Simplifying ratios and rates.)							
Intervention group					-12.170	.000	2.149
Pre-test	48	1.885	1.6086	31			
Post-test	48	5.010	1.2820	84			
Comparison group					-11.422	.000	2.097
Pre-test	43	1.302	1.5203	22			
Post-test	43	4.488	1.5177	75			
Section 2 (6 points: Solving proportions using scale factors.)							
Intervention group					-11.567	.000	2.076
Pre-test	48	2.48	1.924	41			
Post-test	48	5.58	.871	93			
Comparison group					-12.340	.000	2.479
Pre-test	43	2.00	2.104	33			
Post-test	43	5.81	.546	97			
Section 3 (12 points: Setting up and solving proportions given a practical situation.)							
Intervention group					-14.244	.000	2.383
Pre-test	48	4.13	3.362	34			
Post-test	48	10.854	2.1486	90			
Comparison group					-11.609	.000	2.343
Pre-test	43	3.65	3.366	30			
Post-test	43	10.605	2.5085	88			
Section 4 (6 points: Using proportions to solve problems involving similar figures.)							
Intervention group					-12.414	.000	2.124
Pre-test	48	1.71	1.913	29			
Post-test	48	5.229	1.3525	87			
Comparison group					-18.451	.000	3.858
Pre-test	43	1.07	1.580	18			
Post-test	43	5.767	.6844	96			
Section 5 (12 points: Using proportions to determine percentages.)							
Intervention group					-7.843	.000	1.530
Pre-test	48	.63	5.110	47			
Post-test	48	11.490	1.7968	96			
Comparison group					-16.341	.000	3.108
Pre-test	43	1.65	2.707	14			
Post-test	43	10.814	3.1717	90			

Section 6 (9 points: Using proportions to convert from a % to degrees of a circle.)

Intervention group					-11.231	.000	2.120
Pre-test	48	2.27	3.630	25			
Post-test	48	8.375	1.8465	93			
Comparison group					-17.253	.000	3.511
Pre-test	43	.56	1.763	06			
Post-test	43	8.116	2.4805	90			

Section 7 (4 points: Given degree measures, using a protractor to create a pie chart.)

Intervention group					-3.625	.001	.749
Pre-test	48	3.15	1.502	79			
Post-test	48	3.96	.289	99			
Comparison group					-7.059	.000	.985
Pre-test	43	2.00	1.732	50			
Post-test	43	3.63	.900	91			