Integrating Nutrition Content into High School Courses: Sample Lesson Plans for Teachers

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ABSTRACT

Obesity and overweight are common in the United States. The Centers for Disease Control and Prevention suggest that obesity affects 1 in 5 adolescents in the United States and may lead to an increased risk for a variety of other health issues including high blood pressure and diabetes. With the high prevalence of overweight and obesity, it is important that youth are educated on the impacts of obesity and how it can be prevented through nutrition education. This project seeks to provide teachers with lesson plans to educate high school students on nutritional topics. The lesson plans were created by integrating nutrition content into various core subjects including math, science, and English. Integrating nutrition content into other subjects allows the classroom teacher to address nutrition while requiring few additional resources or time. All lesson plans were evaluated by a registered dietician and a licensed Virginia teacher for the corresponding subject. The lesson plans are intended to be a starting point for a larger scale program that would address other factors including food environment and community involvement. In the future, the lessons should be carried out in a classroom setting, student nutritional knowledge should be evaluated before and after instruction, and the lesson plans should be modified accordingly.
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Introduction

Obesity and overweight is a widespread issue that can lead to harmful and potentially deadly health issues if the weight gain is not corrected. A National Health and Nutrition Examination Survey from 2013-2014 indicated that 1 in 3 adults and 1 in 6 adolescents were categorized as obese (National Institute of Health, 2017). According to the Centers for Disease Control and Prevention, people who are obese and overweight are put at higher risk for diseases such as hypertension, coronary heart disease, and certain cancers than individuals of normal weight (2015). Diseases and other health problems associated with obesity lead to an increase in expenses for medical care and procedures. In a European study, severe obesity was associated with a 26% increase in direct medical costs while moderate obesity and overweight were associated with a 16% and 8.5% increase, respectively, compared to normal weight individuals (Mora et al., 2015). A U.S. study estimated the lifetime direct medical costs for a child who is overweight compared to a child of normal weight who maintains his/her weight throughout adulthood to be $19,000 (Finkelstein et al., 2014).

In addition to the economic impact, obesity has implications for mental health. The results of a study by Tevie and Shaya (2014) suggest that obesity and hypertension are associated with increased odds of poor mental health in a population of youth and adolescents; however, they note that while mental health was a function of obesity and hypertension in the study, it is reasonable to think that the opposite may be true. Another study showed that increases in BMI significantly increased depressed days; however, similar to the previously mentioned study, there is still the issue of reverse causality and further research is necessary (Ha et al., 2017). While these and other studies have indicated an association between mental health
and obesity, the relationship is a complicated one and the studies do not necessarily indicate that obesity causes depression.

It is necessary that young people are educated early on about the consequences of obesity and how to prevent or correct the condition for several reasons. First, children who are obese often become obese adults. A review of several studies indicated that the risk for adult obesity was at least twice as high for children who were obese compared to children who were not obese (Serdula et al., 1993). Additionally, it is important to attempt to prevent weight gain early on because it is often harder to maintain weight loss than to maintain a normal body weight. Kruseman et al. (2017) found that people with a lifetime stable normal weight had a more relaxed attitude about food and were able to make adjustments more intuitively compared to weight loss maintainers. Finally, it may be easier for children to lose weight than adults. A study by Epstein et al. (1995) found that children who were obese showed better weight loss and were able to maintain better than parents who were obese due to a variety of behavioral and biological factors.

**Literature Review**

*Overview*

The need for obesity interventions that target adolescents has become even clearer in recent years as childhood obesity rates increase and may be continued into adulthood (Ilas, 2015). Increases in obesity rates are concerning because obesity is associated with conditions such as hypertension and heart disease (Centers for Disease Control and Prevention), increased medical costs (Mora et al., 2015; Finkelstein et al., 2014) and mental health concerns (Tevie & Shaya, 2014; Ha et al., 2017). Beech et al. (1999) suggests there is a need for multifaceted
school-based nutrition education programs to address low nutrition knowledge levels and daily fruit and vegetable consumption among adolescents.

**Lack of Nutritional Knowledge**

Nutrition education programs are necessary because youth often lack the knowledge necessary to make informed choices regarding their nutrition. In a study of 250 eighth graders from North Carolina, an instrument designed to measure nutrition knowledge indicated that participants knew only half of the nutritional knowledge expected by eight grade (Hodges et al., 2017). This lack of nutritional knowledge is exacerbated in families with low educational and low income status. One study showed that children of parents with the lowest level of education scored lowest in nutrition knowledge and eating behaviors (Qian, 2017). Another study of 68 Massachusetts school districts also showed the need for nutrition interventions in schools in low-income communities. According to the study, there was a 1.17% increase in overweight and obese status was for every 1% increase in low-income (Rogers et al., 2015). Teaching nutrition in schools has shown to improve nutritional knowledge, attitude, (Watson et al., 2009), and behaviors (Heo et al., 2016).

**Cost-effectiveness**

Developing effective nutrition education in schools may be cost effective in the long run. A standard cost-effectiveness analysis model of 5th graders in a New York City public school suggests that, after one year of nutrition education curriculum, 1,600 years of life and $8 million in medical expenses would be saved (Graziose et al., 2016). Hence, the extra cost of adopting a nutritional curriculum and the resources needed to teach it may pay off in the end. Despite this, many school districts are limited by money, resources, and time; and nutrition education is often not made a priority. According to a 2010 article from the Journal of the Academy of Nutrition
and Dietetics, despite support of nutrition promotion and education through the USDA's Team Nutrition Network in the Child Nutrition and WIC Reauthorization Act of 2004, funds were never actually appropriated to carry out the requirements of the legislation. Additionally, in an attempt to meet mandates of The No Child Left Behind Act of 2001, many schools eliminated nutrition education and physical education; hence, there is a need for mandatory, consistent funding for nutrition education and health promotion (Briggs, 2010). It is important to think of novel ways to incorporate nutrition content into the curriculum while minimizing cost and resources. Addition of nutrition content into courses that already exist is an easy way to incorporate nutrition content without additional money, resources, and time; however, it is not intended to be a complete solution and advocating for funding for additional nutrition education and interventions is necessary.

**Attitude and Behavioral Changes**

Delivery of a nutrition curriculum in schools may positively impact youth attitude towards food and result in healthier food behaviors (Watson et al., 2009). A group of 45 ninth to twelfth grade students at a North Texas high school who received a health education intervention saw significant increases in nutritional knowledge, some positive changes in attitude toward nutrition, and small changes in food consumption behaviors compared to the control group when evaluated using a questionnaire at the beginning and end of the course. The study group was enrolled in one of two semester-long family and consumer science courses – nutrition and food science or sports nutrition/food science and technology – while the control group participated in other semester-long family and consumer science courses which did not have a nutrition component (Watson et al., 2009). In another study of 2,255 New York City high school students, boys showed increases in fruit and vegetable consumption and girls showed decreases
in sugar-sweetened beverage consumption when they were provided wellness curricula which included promoting changes in diet. This HealthCorps program offered biweekly half-hour to one-hour classes throughout the year in addition to regular events and demonstrations. Of the 1,273 boys and girls who participated in the HealthCorps program and completed both the pre- and postsurvey, the number of total hours of exposure varied as all classes and events were optional (Heo et al., 2016). These studies demonstrate the successes that can be seen through varying degrees of youth nutrition education efforts.

*Integrating Nutrition into Core Subjects*

Despite the many positive outcomes achieved through youth education efforts, nutrition education in schools comes with a unique set of challenges including lack of time (Perera et al., 2015) and resources (Jones et al., 2015). With the heavy focus on statewide standardized testing, many teachers feel there is insufficient time to dedicate to nutrition education; however, this may provide an opportunity to integrate nutrition content into math, science, and English curricula (Perera et al., 2015). Through integration of nutrition into other curricula, students can potentially increase academic knowledge, health, and performance on standardized tests simultaneously (Stage et al., 2018). In addition to lack of time, teachers also report lack of sufficient resources to teach nutrition and the belief that their content is unrelated to nutrition (Jones et al., 2015). This emphasizes the importance of developing interdisciplinary resources that allow teachers to teach nutrition and their content simultaneously thus eliminating the need for an additional time commitment. Nonetheless, Perera et al. (2015) suggests that nutrition education will have a limited impact unless it is accompanied by food environments at home and school that reflect what is being taught.

*Multifaceted programs*
Although nutrition education interventions showed positive outcomes in the aforementioned studies, nutrition education used in combination with other interventions would provide multiple opportunities for success. A multilevel comparison of the effectiveness of several school programs aimed at preventing childhood obesity showed that effectiveness of school programs varied depending on multiple components including content, community involvement, funding, and program delivery (Veugelers & Fitzgerald, 2005). The study, which compared 5th grade students in 291 public schools in Novia Scotia, found that the most effective programs were intensive and multifaced and integrated CDC guidelines including recommendations involving school policy, curriculum and instruction, integration of food services, nutrition education, staff training, involvement of families and communities, and evaluation of the program (Veugelers & Fitzgerald, 2005). Within schools, efforts to promote a healthy lifestyle should be developed using an integrated comprehensive model for obesity prevention adapted from a model by Allensworth & Kolbe (1987) which includes components such as school health instruction, services, environment, and community involvement (Story, 1999). Story also suggests that, while schools can play an important role, they cannot help youth achieve and maintain healthy weights on their own and a multi-faceted community wide effort is required. Nutrition education in schools can play an important role in reducing childhood obesity and would be a great starting point for a larger-scale, multi-faceted intervention.

**Purpose**

The aim of this project is to provide lesson plans that educate high school students on the importance of healthy eating in their everyday lives by integrating nutritional information into the core classes. In addition to education at an early age, several other factors like availability of food, convenience, and social norms, must be addressed in order for a nutrition program to be
effective (Neumark-Sztainer, D et al. 1999); thus, this project would make an excellent supplement to a larger-scale program. Including nutrition in the school curriculum is important because the school has more continuous and intensive contact with children during the first two decades of life than any other public institution (Resnicow, 1993). It is important, however, that teachers support the implementation of a nutrition curriculum and believe that they have the time and resources to successfully implement it. Perrera et al. (2015) found that most teachers perceived nutrition education as important but also felt there was insufficient time and lack of a suitable curriculum with some teachers suggesting that we must find ways to put it together with other curriculum. This project seeks to address these issues with the creation of interdisciplinary nutrition lesson plans and resources that can be easily implemented into core classes such as chemistry, English, and math. Resources that combine multiple subjects will allow content teachers to address nutrition without requiring a significant amount of additional time and/or resources.

Students must understand the negative consequences that are associated with various eating habits and how they can be prevented. Healthy eating can drastically improve an individual’s quality of life and save money on medical bills associated with obesity-related illnesses (Oster, 1999). A dynamic model of the relationship between BMI and risks and costs of 5 obesity-related illnesses showed that a 10% weight loss would reduce the years of life of hypertension, hypercholesterolemia, and type 2 diabetes, reduce the expected lifetime incidence of CHD and stroke, increase life expectancy by 2 to 7 months, and reduce expected lifetime medical costs by $2200 to $5300. The extent of the benefits shown in the model varied by age, gender, and initial BMI (Oster, 1999). Schools must provide students with the knowledge to make healthy food choices and the understanding that healthy eating is possible. Additionally,
they must do so in a way that makes it possible for teachers to effectively and easily implement the curriculum in their classroom. This nutrition curriculum resource project aims to provide teachers with resources to help their students make healthy food choices in spite of the limited time and resources that many teachers have.

Theory

Overweight and obesity often result in negative health consequences such as diabetes, heart disease, and decreased quality of life (Centers for Disease Control and Prevention, 2015). Additionally, the negative health consequences that accompany obesity are usually associated with an increase in medical costs (Mora et al., 2015). In many cases, these unwanted consequences can be prevented if the individual is able to make lifestyle changes such as reducing portion sizes, increasing physical activity, and utilizing behavioral therapy to help modify eating, activity, and thinking habits (Wadden et al., 2012). The aim of the high school nutrition curriculum is to provide high school students with the knowledge necessary to make changes to their behavior in order to prevent the potential negative consequences that are often associated with poor food choices; thus, it is useful for one to consider the theory behind behavior change.

Behavior Change

For an individual to effectively change his behavior, he must have a strong positive intention to perform the behavior, eliminate environmental factors which prevent him from performing the behavior, and have the skills needed to perform the behavior (Fishbein, 1995). It is the intent of the curriculum resources to provide the students with some of the skills needed to make healthy food choices and help develop a strong positive intention to perform the behavior. To do so, the lesson plans will include skills such as showing students how to perform
calculations involving resting energy expenditure and determining the amount of certain macronutrients and micronutrients needed in their diet. Additionally, the lesson plans include information on obesity rates and the consequences associated with obesity in order to help students develop a positive intention to maintain a healthy weight.

The lesson plans also address environmental factors such as access to healthy food options in school vending machines by providing students with the opportunity to read, write, and discuss the topic. Teaching students about environmental factors like competitive foods is a good starting point; however, it is recommended that further action be taken by combining the nutrition curriculum with interventions that specifically address these factors. Environmental factors within schools such as the presence of “competitive” foods in schools may impact student eating behaviors (Fox et al., 2009). While much of the food served at school must meet federal nutrition guidelines, “competitive” foods like those sold in vending machines, through fundraisers, and at school stores are often low in nutrients and energy dense (Fox et al., 2009). One study improved school food environments and student nutrition intake through regulation of these “competitive” foods; however, improvements were somewhat modest because low-fat and reduced sugar alternatives were often low in nutritional value, so additional improvements would likely be necessary (Woodward-Lopez et al., 2010). A combination of nutrition curriculum, school policy, and environmental changes will help to address all three factors necessary for effectively changing a behavior. While the scope of this project seeks to address only an aspect of nutrition education, additional changes within the school and surrounding community are likely necessary to see substantial impacts; thus, this project would be an important starting point for a more intensive school health program.
Psychological barriers may also inhibit behavior change such as trivialization, lack of knowledge, low self-efficacy, motivational drift, and lack of social support (Olson, 1992). The nutrition lesson plans include several of the strategies for overcoming psychological barriers. Strategies for overcoming psychological barriers include stating negative effects of not performing the healthy behavior and providing basic information and skills relevant to the new behavior (Olson, 1992). Implementing these lesson plans as part of a larger-scale program will allow more strategies for overcoming these barriers to be used thus increasing the likelihood for success. Additional strategies include addressing competing attitudes that interfere with the new behavior and involving families in the behavior change (Olson, 1992). These lesson plans represent an important starting point for a multifaceted program that involves the students’ families and the community.

**Methods**

*Project Design*

The project includes sample lesson plans that teach English, math, and science content while integrating nutrition content into lessons. Each lesson plan was created to be versatile and serve many functions including teaching nutrition topics, teaching content topics according to the Virginia Standards of Learning, engaging students, and providing opportunities for students to demonstrate understanding, collaborate with peers, and self-reflect. Each lesson plan was reviewed and evaluated by a registered dietician and a licensed Virginia high school teacher qualified to teach the topic at hand. Suggestions from the evaluators were used to modify lessons in order to improve the accuracy and quality. Teachers were not required to carry out the lesson in their classrooms, only to provide input based on their educational expertise and
knowledge of the subject content. These lessons have not yet been delivered to students and the projects does not assess the impacts on the lesson on students.

Lesson Design

The proposed lessons aim to improve nutritional knowledge and awareness for high school students in grades 9-12 through active learning. Chickering and Gamson (1987) describe active learning as more than just having students passively listen to teachers; rather, they should be talking and writing about what they are learning, relating it to past experiences, and applying it to their daily lives through structured exercises, discussions, team projects, and peer critiques. Lesson plans included in this project involve a combination of hands-on labs, brief video clips, reading, writing, peer evaluation, and student reflection.

Each lesson will provide active learning opportunities in which student are collaborating with one another through activities such as labs, discussions, and the sharing of ideas rather than the teacher being the focus of the instruction. Many of the activities in the lesson plans focus on the teacher facilitating learning rather than directly teaching. The lessons were created with the expectation that students already have prior knowledge of key concepts in chemistry, English, or math prior to the lesson; thus, these lessons are intended to improve student understanding and enrich student learning rather than introduce brand new concepts.

Additionally, the lessons are designed to be interdisciplinary in nature so that student may gain knowledge and understanding in nutrition while practicing English, science, or math skills simultaneously. Interdisciplinary lessons are a way to connect knowledge from multiple disciplines. Sternberg (2008) advocates that most serious problems in today’s world must be solved using problem-based, interdisciplinary thinking because few problems are confined or
narrow. The lessons in this project connect nutrition to other contents rather than looking at nutrition as a distinct discipline allowing students to start making connections. The lessons focus on multiple subjects within and outside of the given content and allow students to draw on real-life experiences.

Nutrition Evaluation

Nutrition content within the lesson plans was evaluated by Michelle Rockwell, MS, RD, CSSD. Mrs. Rockwell has taught nutrition curriculum in the department of Human Nutrition, Foods, and Exercise at Virginia Tech for 4.5 years and has been a registered dietician for 19 years. Additionally, she served as the Director of Sports Nutrition at the University of Florida for five years and as a nutrition consultant at North Carolina State University for three years. She also has experience with private practice nutrition counseling, teaching online weight management classes, and providing lifestyle modification counseling. Mrs. Rockwell evaluated the accuracy of information, made suggestions for improvement, and included modifications to terminology and data sources through a single evaluation. Changes were made to the lesson plans based on Mrs. Rockwell’s feedback prior to sending the lesson plans to high school teachers for further evaluation.

Lesson Plan Evaluation

Lesson plans and supplemental activities were provided to content teachers for a single evaluation. Each lesson was evaluated by a teacher who is licensed to teach the relevant subject in the Commonwealth of Virginia. Lesson plans were evaluated by Lori Hughes, Bonnie Koon, and Adam Curtis, licensed to teach chemistry, English, and math, respectively. Ms. Lori Hughes has a B.S. in chemistry and a M.S. in education and has been teaching high school science for 21
years. Ms. Bonnie Koon has a B.S. in education with a concentration in secondary English and a M.S in education with a concentration in TESOL and has been teaching high school English for 9 years. Mr. Adam Curtis has a B.S. in psychology and a M.S. in education with a concentration in math and has been teaching high school math for two years. Evaluators used Instructional Lesson Plan Review Tools which were adapted from the Next Generation Science Standards Lesson Screener and Achieve EQuIP (Educators Evaluating the Quality of Instructional Products) English and Math Rubrics for Lessons & Units (Achieve, 2018). Lesson Plan Review Tools were modified to incorporate the Virginia Standards of Learning and Curriculum framework (VDOE, 2019). English and math evaluation included alignment with Virginia Standards of Learning, key instructional shifts, instructional supports, and assessment. Science evaluation included explaining phenomena and designing solutions, Virginia Standards of Learning, integrating the standards for instruction and assessment, relevance and authenticity, student ideas, and building on students’ prior knowledge. Evaluation forms included space for suggestions for improvement. It should be noted that the evaluation forms were altered from the original version, and a completed evaluation form does not indicate that the lesson is approved by or associated with Next Generation Science Standards, EQuIP, Achieve, or the Virginia Department of Education. A copy of the completed evaluation forms can be found in appendices D, E, and F for chemistry, English, and math, respectively.

Results & Discussion

The Lesson Plans

The project contains one sample nutrition lesson plan for the core areas of English, math, and science. Each lesson plan includes the reporting categories and/or primary standards of learning (SOL) based on the curriculum framework and standards for that subject, time
allotment, required materials, key vocabulary, prior knowledge (if applicable), and a summary of student and teacher actions. Additionally, some lesson plans include potential lesson extensions or resources with useful information. The lesson plans do not build upon one another and can be delivered independently. They are designed to provide supplemental nutritional education and would likely be most effective as one component of a larger nutrition intervention involving changes in school curriculum, policy, and environment.

The chemistry lesson plan (Appendix A) includes information on calories, macronutrient recommendations, water intake recommendations from the Food and Nutrition Board of the National Academy of Medicine, and a micronutrient (iron) recommendation from the National Institute of Health. Students will perform a calorimetry lab adapted from the Soda Can Calorimeter lab (Flinn Scientific, 2016) to find the approximate number of calories present in various snack foods. Analysis questions from the lab will encourage students to consider how their results might differ for other foods and whether the calories show the whole picture regarding nutritional value of a food. This will lead to the final activity which involves calculations for macronutrients, a micronutrient, and water using dimensional analysis.

The English lesson plan (Appendix B) includes information on childhood obesity and nutritional guidelines provided by the United States Department of Agriculture. The lesson starts off with a class discussion of students' favorite foods followed by time to read an excerpt from Childhood obesity: prevention is better than cure (Pandita et al., 2016). Students will complete comprehension questions following the reading. In the second part of the lesson, students will read two opposing viewpoints relating to school lunch nutrition standards and, in pairs, compare and contrast the main points of the editorials. Finally, students will take a stance on whether or not they agree with the nutritional standards on school vending machines provided by the United
States Department of Agriculture. Students will be provided with access to the internet in addition to a list of resources from the United States Department of Agriculture, the Centers for Disease Control and Prevention, and the National Institutes of Health.

The math lesson plan (Appendix C) includes data on the obesity epidemic from the Centers for Disease Control and Prevention and information on calorie needs and energy expenditure. Math concepts were adapted from Enhance Scope and Sequence Sample Lesson Plans based on 2009 Mathematics Standards of Learning (VDOE, 2019) to contain nutrition information content. Students will graph and analyze data related to obesity trends, compare data, and make predictions for the future. Finally, students will consider calorie needs and perform calculations involving resting energy expenditure, calories consumed, and calories expended through physical activity.

*Implementation of suggestions*

Suggestions from registered dietician Michelle Rockwell included the use of people-first language when referring to people with conditions such as obesity and minor changes in word choice. Additionally, she recommended using the RDA for the micronutrient iron rather than sodium which is highly variable from person to person.

Recommendations for the chemistry lesson plan are notated in Appendix D and include the use of a temperature probe rather than a thermometer in the lab portion of the lesson in order to be able to more easily and precisely identify the high temperature. The English lesson plan evaluation form (Appendix E) included suggestions of adding a counterargument to the writing sample, use of the Scholastic Persuasive Essay Rubric evaluation tool (Appendix G), a Venn-diagram, and additional minor changes. Suggestions for the math lesson plan included a
suggestion for a possible extension to the assignment. All suggestions were carefully considered and implemented into the final version of the lesson plans.

Future considerations

The lesson plans included in this project are not intended to provide students with a comprehensive knowledge of nutrition nor are they intended to decrease obesity rates in the target community. These types of major changes are outside of the scope of this project which aims to get students talking about, thinking about, and understanding the basics of nutrition and its importance in their lives. These are sample lesson plans and should serve as one small piece in an effort to improve healthy eating choices in schools and a starting point for a more intensive program. Additional lesson plans should be created into the future to include other nutritional topics such as specific micronutrients. In order to make a more powerful impact, these and similar lessons should be implemented in schools in addition to environmental and behavioral changes both inside the school and the home. Furthermore, students could apply the information they learned throughout the school day such as through calculating calories expended during gym class or calories consumed in the cafeteria.

Additionally, the effectiveness of the lesson plans should be evaluated in the future. Student nutritional knowledge and behaviors should be evaluated pre- and post-lesson to see if they are improved after delivery of each lesson. Modifications to lessons should be made based on student feedback and analysis of changes in student knowledge and behaviors.

Increased obesity rates and lack of student knowledge of nutrition indicate the need for nutrition curriculum in schools. Many schools have had varying degrees of success through the integration of nutrition curriculum including changes in student food behaviors, knowledge, and
attitude toward food. Nonetheless, several challenges exist when considering the implementation of a nutrition curriculum including those related to time and resources. Given these unique challenges, the integration of nutrition content within core high school classes would be useful.
References


Scholastic. Persuasive Essay Rubric. Retrieved from


Appendix A

Chemistry & Nutrition Lesson Plan

Reporting Category  Scientific Investigation; Kinetic Molecular Theory

Primary SOL(s)  CH.1 - The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated produce observations and verifiable data.
CH.5 - The student will investigate and understand that the phases of matter are explained by kinetic theory and forces of attraction between particles.

Allotted time  1-2 class periods

Materials

- Internet access
- Empty soda cans
- Stirring rods
- Ring stands & rings
- Graduated cylinders
- Dimensional analysis activity sheet
- Balances
- Corks
- Paperclips
- Marshmallows
- Cheese puffs
- Popcorn
- Water
- Thermometers
- Lighters
- Safety goggles
- Lab sheet

Vocabulary

Calorimeter, calorie, specific heat capacity
Prior Knowledge

Before the lesson, students should have a basic understanding of solving problems using dimensional analysis and specific heat capacity.

Student/Teacher Actions

2. Tell students that they will be creating their own calorimeters to determine the calorie content of various foods. Pass out lab sheet and facilitate students as they complete Snack Calorimetry Lab.
3. Provide a data table on the board for students to compare class data for calorie content of each of the food samples.
4. Distribute copies of Dietary Dimensional Analysis sheet.

Assessment

- Questions
  o Determine the number of calories per gram in each of the following macronutrients:
    (a) Carbohydrates _____  (b) Fat _____  (c) Protein _____
  o A student uses a calorimeter to determine the Calorie content in a piece of popcorn. Upon combustion of the popcorn, the temperature of a 60.0 g sample of water raises by 4.5°C. Calculate the number of Calories in the piece of popcorn.
  o Explain why the calorimeter you made would not be a very precise tool for a scientist to use to calculate the actual calorie content of a food.
Snack Calorimetry Lab

Adapted from “Soda Can Calorimeter” – Flinn Scientific

Introduction

Calories are a unit used to measure energy. Although the familiar term is calorie, the calories in our food are actually kilocalories (often expressed as Calorie with a capital “C”). When we consume food, the calories in our food provide us with the fuel our body needs to function. The 2015-2020 Dietary Guidelines for Americans suggests that teenage boys consume 2,000-3,200 calories per day and teenage girls consume 1,600-2,400 calories per day. As you can see the range of recommended daily calories is broad and, thus, will vary from person to person depending upon factors like activity level.

Not all foods are equal when it comes to nutritional value. Some foods are very calorie dense despite being very low in nutrients like vitamins and minerals. In today’s lab, you will explore the calorie content in various foods.

Safety:

Safety goggles should be worn at all times and long hair should be pulled back around an open flame. Do not leave flame unattended. Be sure to work in a well ventilated area. No food or drink should be consumed in the laboratory. Wash hands thoroughly after the lab.

Virginia Standards of Learning:

CH.1 - The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated produce observations and verifiable data.

CH.5 - The student will investigate and understand that the phases of matter are explained by kinetic theory and forces of attraction between particles.

Materials

Procedure:

1. Obtain a ring stand and ring. Adjust the height of the ring to just slightly below the middle of the ring stand.
2. Obtain an empty soda can. Be sure the can has been washed thoroughly and is free of any residue.
3. Use a graduated cylinder to carefully measure 50.0 mL of water into an empty soda can.
4. Extend the tab of the soda can and insert a glass rod through the hole in the tab allowing the stirring to rest on the metal ring attached to the ring stand as demonstrated by your teacher.
5. You will use a cork and a paperclip to create an apparatus to hold your piece of food. Carefully unwind the paperclip, and stick one end into the cork and allow one end to remain free as shown in the diagram shown.
(6) Attach the piece of food your group has been assigned (marshmallow, cheese puff, or tater tot) to the open end of the paperclip. Record the mass of the food and apparatus in your data table.

(7) Place the food and apparatus below the soda can. If the bottom of the soda can is not 2-3 cm from the food, you may need to readjust the ring.

(8) Insert a thermometer into the open can and record the initial water temperature. Record this value in your data table.

(9) Light the food sample using a safety lighter. Once the food has stopped burning, record the final temperature of the water in the can.

(10) Measure and record the final mass of the food and apparatus.

(11) Once you have allowed the can to cool, clean any residue from the can and the food apparatus and return your materials.

**Data Table:**

<table>
<thead>
<tr>
<th>Initial Mass of Food + Apparatus (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Mass of Food + Apparatus (g)</td>
</tr>
<tr>
<td>Initial Water Temperature (℃)</td>
</tr>
<tr>
<td>Final Water Temperature (℃)</td>
</tr>
</tbody>
</table>

**Calculations:**

1. Determine the change in temperature of your water sample and the change in mass of your food sample.

2. Use \( q=mc\Delta t \) to determine the amount of heat energy absorbed by the water. Recall that the specific heat of water is 1 cal/g℃.

3. We will assume that the heat absorbed by the water is the same as the heat released by the food sample. Recall that the calories in food are actually kilocalories, referred to as Calories with a capital “C.” Convert your answer for #2 to Calories.

4. Using the mass of sample burned, calculate the number of Calories per gram for your food sample. Add your answer to the class data on the board.
Analysis:

1. Compare the data for your food sample to the data collected by the other groups. Which food contains the most calories per gram?

2. How does the calorie content collected by you and your peers compare to the data on the nutrition facts label? Why might they be different?

3. If you had performed a similar experiment using bell peppers, how do you think your data would be different?

4. Do you think calorie content shows the whole picture regarding nutrition value of a food? What else should we consider when choosing the foods we eat?
Chemistry & Nutrition: Dietary Dimensional Analysis

Introduction:

The calories we consume are derived primarily from three macronutrients which include carbohydrates, protein, and fat. These are all sources of calories and are necessary in various amounts for a healthy diet. Fat contributes 9 calories per gram while carbohydrates and protein each contribute 4 calories per gram. Recommended intake of each macronutrient varies depending upon age, sex, activity level, and other variables. The RDA, Recommended Dietary Allowance, for protein, for example, ranges from 0.8 g per kg of bodyweight for sedentary people to 2.0 g per kg of bodyweight for active people. (Thompson & Manroe, 2017).

In addition, your body needs micronutrients to carry out many of the functions necessary to survive. Micronutrients include vitamins and minerals such as vitamin B12, iron, and sodium. Although your body needs these in much smaller amounts, they play vital roles in human physiology.

SOL: Ch.1g – convert measurements using dimensional analysis.

Directions: Perform the dietary calculations below. Show all work using dimensional analysis. Round all answers to one decimal place.

1. Alexis weighs 136 pounds and spends most of her day sitting at a desk. Determine the minimum number of calories of protein she should consume each day. (1 kg = 2.2 lb)

2. In the morning before school, Alexis decided to make quiche for her and her siblings. The recipe calls for 1.25 cups of egg whites.
   a. The nutrition facts label states that liquid egg whites contain 5 grams of protein for every 3 tablespoon serving. If she adds 1.25 cups of egg whites to her recipe, how many calories of protein will she consume from the egg whites? (1 cup = 16 tablespoons)

3. According to the Food and Nutrition Board of the National Academy of Medicine, adolescents aged 13-18 should consume approximately 3.3 L of water each day. Alexis’ water bottle holds 32 oz of water. Determine the number of water bottles she will need to consume to meet the recommended water intake. (1 gal = 3.79L; 128 oz = 1 gal)
4. The National Institute of Health recommends that boys ages 14-18 consume 11 grams of iron and girls ages 14-18 consume 15 grams of iron. For a snack, Alexis eats snack mix. The label on the snack mix says that one \( \frac{1}{2} \) cup serving contains 1.2 mg of iron. Alexis consumes 1.25 cups of the snack mix.

   a. How many grams of iron has she consumed? Express this number in scientific notation.

   b. What percentage of her daily intake is this? Would you consider this snack to be a good source of iron?
Chemistry & Nutrition: Dietary Dimensional Analysis KEY

Introduction:

The calories we consume are composed primarily of three macronutrients which include carbohydrates, protein, and fat. These are all sources of calories and are necessary in various amounts for a healthy diet. Fat contributes 9 calories per gram while carbohydrates and protein each contribute 4 calories per gram. Recommended intake of each macronutrient varies depending upon age, sex, activity level, and other variables. The RDA, recommended dietary intake, for protein, for example, ranges from 0.8 g per kg of bodyweight for sedentary people to 2.0 g per kg of bodyweight for active people. (Thompson & Manore, 2017).

In addition, your body needs micronutrients to carry out many of the functions necessary to survive. Micronutrients include vitamins and minerals such as vitamin B12, iron, and sodium. Although your body needs these in much smaller amounts, they play vital roles in human physiology.

SOL: Ch.1g – convert measurements using dimensional analysis.

Directions: Perform the dietary calculations below. Show all work using dimensional analysis. Round all answers to one decimal place.

1. Alexis weighs 136 pounds and spends most of her day sitting at a desk. Determine the minimum number of calories of protein she should consume each day. (1 kg = 2.2 lb)

\[
136 \text{ lb} \times \frac{1 \text{ kg}}{2.2 \text{ lb}} \times \frac{0.8 \text{ g}}{1 \text{ kg}} \times \frac{4 \text{ cal}}{1 \text{ g}} = 198 \text{ cal}
\]

1. In the morning before school, Alexis decided to make quiche for her and her siblings. The recipe calls for 1.25 cups of egg whites.
   a. The nutrition facts label states that liquid egg whites contain 5 grams of protein for every 3 tablespoon serving. If she adds 1.25 cups of egg whites to her recipe, how many calories of protein will she consume from the egg whites? (1 cup = 16 tablespoons)

\[
1.25 \text{ cup} \times \frac{16 \text{ tbsp}}{1 \text{ cup}} \times \frac{5 \text{ g}}{3 \text{ tbsp}} \times \frac{4 \text{ cal}}{1 \text{ g}} = 133 \text{ cal}
\]

1. According to the Food and Nutrition Board of the National Academy of Medicine, adolescents aged 13-18 should consume approximately 3.3 L of water each day. Alexis’
water bottle holds 32 oz of water. Determine the number of water bottles she will need to consume to meet the recommended water intake. (1 gal = 3.79L; 128 oz = 1 gal)

\[
3.3 \text{ L} \times \frac{1 \text{ gal}}{3.79 \text{ L}} \times \frac{128 \text{ oz}}{1 \text{ gal}} \times \frac{1 \text{ bottle}}{32 \text{ oz}} = 3.5 \text{ bottles}
\]

1. The National Institute of Health recommends that boys ages 14-18 consume 11 grams of iron and girls consume ages 14-18 consume 15 grams of iron. For a snack, Alexis eats snack mix. The label on the snack mix says that one \( \frac{1}{2} \) cup serving of contains 1.2 mg of iron. Alexis consumes 1.25 cups of the snack mix.
   a. How many grams of sodium has she consumed? Express this number in scientific notation.

\[
1.25 \text{ cups} \times \frac{1.2 \text{ mg}}{0.5 \text{ cups}} \times \frac{1 \text{ g}}{1000 \text{ mg}} = 3 \times 10^{-3} \text{ g}
\]

b. What percentage of her daily intake is this? Would you consider this snack to be a good source of iron?

\[
\frac{0.003}{15} \times 100 = 0.02\%, \text{ No it is very low in iron}
\]
Appendix B

English & Nutrition Lesson Plan

Primary SOL(s)  10.5, 10.6
Allotted time  2 class periods

Materials

- “Why should we care about childhood obesity?” Reading Comprehension Worksheet
- Opinion Articles
- Compare and Contrast Map
- 3-2-1 Exit Pass

Student/Teacher Actions

Day 1

1. Hook: Teacher will ask students to consider their favorite foods and facilitate discussion about whether or not students think these foods are healthy.

2. Provide students with “Why should we care about childhood obesity?” excerpt and comprehension questions. Allow time for students to read article and respond to questions individually. Regroup for brief class discussion of article.

3. Pair up students. Provide each student with one of the following articles: “The Trump administration is making school lunches less healthy again” or “Hey Michelle Obama, Stay Out of My Kitchen.”

4. Allow students time to read articles individually and respond to questions. Once students are finished, have them share responses with their partner and complete the Compare and Contrast map.

5. Have students complete 3-2-1 exit pass.

Day 2

6. Provide students with writing prompt.

Additional Resources

[https://www.choosemyplate.gov/](https://www.choosemyplate.gov/)
[https://www.nhlbi.nih.gov/health/educational/wecan/tools-resources/nutrition.htm](https://www.nhlbi.nih.gov/health/educational/wecan/tools-resources/nutrition.htm)
Why Should We Care About Childhood Obesity?

Reading Comprehension

Directions: Read the excerpt and complete the comprehension questions that follow.

The following excerpt is an excerpt from *Childhood obesity: prevention is better than cure* (Pandita et. al, 2016).

“Why should we care about childhood obesity?

There are two main reasons to target childhood obesity. First, overweight and obese children and teens are much more likely to become obese as adults compared to normal BMI children, and second, it is more challenging for these adults to lose the excess weight once they become obese. Newer drugs and bariatric procedures for treating obesity-related health problems have emerged but these procedures are costly and have their own complications. Thus, prevention of childhood obesity with emphasis on increased physical activity is of prime importance.

The modern society and culture has managed to oust routine physical activity out of everyday life for most children and made energy dense, low nutrient food and beverages more affordable and accessible, making them far more appealing than their healthier counterparts. Behavioral changes and lifestyle modifications are the primary tools for reducing obesity. However, if the environment contributes to the unhealthy eating practices and sedentary lifestyle, strategies and interventions relying solely on individual “self-control” will not be very effective. Children are less equipped to make informed choices about what is healthy and what is not, making it all the more important to concentrate on modifying the environment. This will provide children with healthy food options and improve their physical activity level, thus reducing the risk of obesity.

Furthermore, obese children today are getting affected by diseases and health problems previously observed only in adults; many obese children today are developing health problems that once afflicted only adults. Chronic illnesses like diabetes mellitus and heart disease have an earlier onset and a prolonged course in these obese children, and even though the disease might remain undiagnosed until adulthood, the resulting complications are more severe leading to a shorter life. Childhood obesity leads to many short- and long-term complications.”

1. The authors of the article would *least likely* agree with which of the following statements?
(a) A child’s environment impacts his/her eating habits and physical activity level
(b) Children who are obese are more likely to have health problems when they reach adulthood
(c) **The key to ending childhood obesity is the creation of new drugs and procedures**
(d) Behavioral changes, lifestyle modifications, and environment modifications are all necessary to reduce childhood obesity.

2. What is the best definition of the word “environment” in this context?
(a) Of or relating to natural world
(b) A person’s geographic location at any given time
(c) **The surroundings or conditions within which a behavior takes place**
3. Which of the following is not a reason the article suggests children may choose unhealthy foods over healthy ones?

(a) **Children generally do not like healthy food**
(b) Unhealthy foods are more easily accessible
(c) Unhealthy foods cost less than healthy ones
(d) Children don’t yet have the knowledge to decide what is and is not healthy

4. Based on the excerpt, which of the following is unlikely to be addressed in the rest of the article?

(a) Behavioral strategies for preventing childhood obesity
(b) Using physical activity as a component for obesity prevention
(c) Reducing environmental signals that contribute to unhealthy behaviors
(d) **Suggestions for treating diabetes mellitus and heart disease**

5. People-first language is often preferred when referring to people who have a health condition or disability. This type of language shows respect and emphasizes the person first rather than allowing the condition to define him/her. For example, “person who is hard of hearing” is preferred over “hearing impaired,” and “person with a physical disability” is preferred over “crippled.” How can you reword the following sentence from the excerpt using people-first language? “Chronic illnesses like diabetes mellitus and heart disease have an earlier onset and a prolonged course in these obese children.”

**Example:** Chronic illnesses like diabetes mellitus and heart disease have an earlier onset and a prolonged course in children who have obesity.
School Lunches: Opposing Views

You and your partner will each receive an editorial with opposing opinions on the topic of school lunches. Read the editorial you are assigned and respond to the following:

- What is the topic of the editorial?
- How would you summarize the opinion expressed by the writer?
- What are some examples of emotional or loaded language used by the writer to slant the point of view in his/her editorial?
- What are some specific words or phrases that reflect the stance of the writer or that appeal to the target audience?

When you are finished, pair up with your partner and share your responses. Together, complete the compare and contrast map below.

<table>
<thead>
<tr>
<th>Article 1: Hey Michelle Obama, Stay Out of My Kitchen</th>
<th>Article 2: The Trump administration is making school lunches less healthy again</th>
</tr>
</thead>
</table>

How are the articles alike?

How are the articles different?


Defending a Position

Consider the articles you read in class yesterday and respond to the following prompt:

Starting in the 2014-15 school year, all school vending machines were required to meet certain nutritional guidelines provided by the United States Department of Agriculture. Do you agree or disagree with this decision? Pick a stance and defend your position. Your response should include an introduction, three paragraphs containing supporting arguments, a counterargument and a conclusion.
### 3-2-1 Exit Pass

<table>
<thead>
<tr>
<th>Three things I learned:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Two Questions I have:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>One opinion I have:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Hey Michelle Obama, Stay Out of My Kitchen

The First Lady shouldn't dictate what kids can and can't eat at school.

By Mercedes Schlapp, Contributor

U.S. News & World Report

May 30, 2014, at 3:30 p.m.

HOW MANY TIMES DID YOUR parents tell you to eat your food because there were starving children in Africa? Throwing away food was considered a sin in my family. In schools across the country, students are tossing out the whole grain tortillas and the extra vegetables and fruits that are being forced onto their plates. Yet first lady Michelle Obama believes that implementing mandates on local school districts and dictating nutritional standards from 1600 Pennsylvania Avenue is the solution to the obesity problems in America’s youth.

Mrs. Obama’s heart might be in the right place, but the administration’s mandates are impractical, create waste and are costly to the local school districts. So Congressional Republicans are proposing a measure that would allow school districts to temporarily opt out of the nutritional standards. The House bill would give schools 12 months to comply.

Yet Mrs. Obama and the administration refuse to provide flexibility to schools that might not be in the best position to make the transition. The process for schools can be expensive and some school districts are forced to choose where to spend their funds: the classroom or the cafeteria.

Providing a waiver for these schools should be just as easy as the waivers that President Barack Obama granted to the big corporations on the Affordable Care Act. In fact, the U.S. Department of Health and Human Services granted waivers to approximately 1,200 companies as a sign of its flexibility to the new law. But President Obama and the administration are being completely inflexible and refusing to give waivers to our schools. Talk about a double standard.

School districts should also be allowed to decide the nutritional standards for their own local schools based on cultural preferences, cost effectiveness and healthy options that students will actually eat. Allowing flexibility to local school districts to set their own nutritional standards and having parents involved in the process is a win-win for the students.

The larger issue is the wasted food, especially as food prices continue to skyrocket. A former cafeteria employee at a local elementary school recounted to me how the majority of students would just toss an uneaten apple, banana or the vegetable of the day in the garbage.

According to a report from the National Resources Defense Council, close to 40 percent of food in the U.S. is never eaten, which is approximately $165 billion in waste. Liberals should be outraged, but Mrs. Obama and the administration’s mandates are adding to the problem of more food being thrown away at the schools.
In her recent New York Times editorial, Mrs. Obama even picked a fight with the beloved potato (my daughter’s favorite vegetable). She argues that “many women and children already consume enough potatoes.” Really? Are mashed potatoes that bad for you? Speak for yourself, Mrs. Obama. It is stressful enough for families these days, especially single moms who are working, raising children and figuring out what to make for dinner every night for their children. Women do not need the first lady or the Obama administration to tell them what and how to eat. The Republicans simply want to provide flexibility to low-income women who receive WIC benefits so that they are in charge of making food choices for their families.

As a working mother of a large family, preparing meals and shopping for groceries is time consuming and hard work. I have learned a valuable lesson from my own mother: Good nutrition starts in the home. In my home, it takes some negotiating: eat a vegetable and you may get a special treat. It seems to work for my five children. Fortunately for my yellow lab, she gets the scraps that end up on the ground, which has become one way of eliminating food without throwing it in the garbage.

While Mrs. Obama has used her bully pulpit for promoting good nutrition and exercise, American women understand the message of providing healthy options for their families; however, they don’t need the first lady to make our schools and our families’ nutritional decisions. The last time I checked the White House chef prepared the first family’s meals – not an option for American moms. My advice to Mrs. Obama and the administration is to stay out of our kitchens and stop unnecessary wasteful and costly mandates for our local schools.
The Trump administration is making school lunches less healthy again

By Editorial Board
Washington Post
December 18, 2018

THE TRUMP ADMINISTRATION is making school lunches less healthy. Last week, it codified a substantial relaxation in federal standards that the Agriculture Department says were too demanding. In fact, the requirements were not the burden the administration makes them out to be. If anything, they should have been tougher.

Congress in 2010 mandated higher nutritional standards for the lunches some 99,000 schools serve to 30 million children in the National School Lunch Program. The program subsidizes the cost of food for students from low-income families and, in return, participating schools must meet certain standards — such as not serving food loaded with saturated fat, packed with refined carbohydrates and lacking in fruits or vegetables. The Agriculture Department is rolling back the requirements, allowing more refined carbohydrates — which promote obesity and diabetes — and more fat in chocolate and other flavored milks.

The stated rationale is that schools cannot afford to serve food that is both nutritious and appealing. Yet there is an exemption process for struggling schools. Nearly every school in the country has managed to comply.

Supposedly, students are throwing away the healthy foods. “If kids are not eating what is being served, they are not benefiting, and food is being wasted,” Agriculture Secretary Sonny Perdue said this month. But a 2015 study found that students ate more fruit and did not throw out more of their meals under the new standards. A 2016 study found no association between food type and plate waste. Early research indicates that school lunch changes alter students’ eating habits over time, suggesting that early impressions of nutrition standards might not capture how beneficial they will be in the long term. More research is needed. But the claim that children are just tossing out their federally required apples is not supported.

This is not to say the standards can never change. Some experts say federal sodium limits, which the Agriculture Department is also shifting, might have been too aggressive. Yet, for the most part, the standards should get tougher over time. Instead of allowing higher-fat flavored milks to be served, it would be better not to serve sugar-packed chocolate milk at all.

As with the original requirements now under attack, it might take some time to adjust to healthier standards. But the rules are not in place for the convenience of lunch-line workers or the food industry that benefits from federal school lunch spending. They exist to help children grow in healthy ways. The government should not be shoveling junk onto poor children’s plates, aiding the all-too-common slide into obesity and chronic disease among the most vulnerable Americans.
Appendix C

Math & Nutrition Lesson Plan

Reporting Category  Equations and Inequalities
Statistics

Primary SOL(s)  A.4 The student will solve e) practical problems involving equations and systems of equations.
A.5 The student will c) solve practical problems involving inequalities;
A.9 The student will collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve practical problems, using mathematical models of linear and quadratic functions.

Allotted time  1-2 class periods

Materials

- Graphing calculator

Vocabulary

- line of best fit, scatterplot, correlation coefficient, independent variable, dependent variable, extrapolate, inequality, solution

Student/Teacher Actions

1. Show students *The Obesity Epidemic* from the CDC.

2. Pass out *Obesity in the United States* worksheet and put students in small groups of three students. Have students compare and contrast graphs for each category.

3. Show students *TedEd: What is a calorie?*

Obesity in the United States

Data

The data in the table, from the Centers for Disease Control and Prevention, shows the percentage of U.S. adult men aged 20 and over whose body mass index (BMI) was in the obese category during the survey years listed.

<table>
<thead>
<tr>
<th>Survey Period</th>
<th>White Men</th>
<th>Black Men</th>
<th>Mexican American Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988-1994</td>
<td>20.3</td>
<td>21.1</td>
<td>23.9</td>
</tr>
<tr>
<td>1999-2000</td>
<td>27.3</td>
<td>27.9</td>
<td>28.9</td>
</tr>
<tr>
<td>2001-2002</td>
<td>29.0</td>
<td>27.9</td>
<td>25.9</td>
</tr>
<tr>
<td>2003-2004</td>
<td>31.1</td>
<td>34.0</td>
<td>31.6</td>
</tr>
<tr>
<td>2005-2006</td>
<td>33.0</td>
<td>37.0</td>
<td>27.0</td>
</tr>
<tr>
<td>2007-2008</td>
<td>31.9</td>
<td>37.2</td>
<td>35.8</td>
</tr>
<tr>
<td>2009-2010</td>
<td>36.2</td>
<td>38.8</td>
<td>38.6</td>
</tr>
<tr>
<td>2011-2012</td>
<td>32.4</td>
<td>37.1</td>
<td>44.0</td>
</tr>
<tr>
<td>2013-2014</td>
<td>34.7</td>
<td>38.0</td>
<td>42.2</td>
</tr>
<tr>
<td>2015-2016</td>
<td>37.9</td>
<td>36.9</td>
<td>46.2</td>
</tr>
</tbody>
</table>

Each student in your group should be in charge of the data in one category (white men, black men, Mexican American men). Using a graphing calculator, create a scatter plot for this data comparing the prevalence of obesity over time. Use the end of the survey period for each time (i.e. if the survey period is 1999-2000, you will put 2000 for L1 in your calculator).

1. Find the equation that best fits the data: \( y = \) __________________________

2. On graph paper on the following page, draw the scatter plot and regression curve.

3. What is the correlation coefficient for this data? (Use the DiagnosticOn function on the calculator and the correlation coefficient is \( r \).) What does this mean?

4. Extrapolate the data (make a prediction) for what percentage of adults in the category you have been assigned will be obese in 5 years; in 10 years.

5. Does this model seem reasonable to you? Provide some reasons why the United States has seen an increase in obesity over the past several years.
6. Compare your data to that of your other group members. How does the data differ? How is it similar?
Calorie Needs & Energy Expenditure

Name ___________________________________________ Date __________________

There are many causes of developing obesity. One contributor is regularly consuming more calories than you expend; thus it is useful to understand how many calories your body needs. Calorie needs vary from person to person depending on a variety of factors including activity level, age, and gender. For example, the 2015-2020 Dietary Guidelines for Americans, suggests that a 15-year-old female who is sedentary consume 1,800 calories while a 17-year-old male who is active should consume around 3,200 calories.

Our bodies’ energy expenditure (how many calories our body uses) includes resting metabolic rate (fuel for basic functions such as circulation and nervous functions), thermic effect of food (fuel to process the food we eat), and physical activity.

The World Health Organization determines the body’s resting energy expenditure for 10-18 year old females by starting with a baseline of 749 calories and adding 12.2 calories for every kg of bodyweight. Fill in data in the chart below to indicate the resting energy expenditures for females at the bodyweights shown below.

<table>
<thead>
<tr>
<th>Bodyweight (kg)</th>
<th>Resting Energy Expenditure (Cal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td></td>
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<tr>
<td>60</td>
<td></td>
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<tr>
<td>65</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td></td>
</tr>
<tr>
<td>75</td>
<td></td>
</tr>
</tbody>
</table>

1. Which values change in this situation? _______________________________________
2. What causes the values to change? ___________________________________________
3. What is the independent variable? (causes the change) _________________________
4. What is the dependent variable? (is affected by the change) ___________________
5. Write an equation to represent the situation. _________________________________
6. Isabel calculates her resting energy expenditure to be 1,650 calories. Determine her bodyweight in kilograms.

7. Graph your equation using your graphing calculator. Do your answers match the graph?

8. Resting energy expenditure (REE) does not include any physical activity and must be multiplied by an activity factor to account for exercise and other activity. Activity factors range from 1.6 (lightly active) to 2.4 (extremely active). Determine Isabel’s total energy expenditure if she is lightly active.
Linear Inequalities & Calories

If Alissa wishes to lose weight, she must expend more calories that she is consuming. This means that she must decrease the number of calories she is consuming and/or increase the number of calories she is expending. Alissa’s nutritionist suggests that she consume approximately 2,000 calories each day and exercise regularly.

1. Alissa is using a notebook to keep track of the calories she is consuming each day. By 7:00 PM, she has consumed 1,815 calories. She is still hungry and wishes to have a snack before bed. The popcorn in her pantry is 25 calories per cup. How many cups of popcorn can she consume to in order to stay under her daily goal of 2,000 calories?
   - Write an inequality that could be used to calculate the number of cups of popcorn she can consume.
   - Solve this inequality, and graph the solution set on a number line.
   - Name at least three different solutions that are represented by your graph.

2. Alissa knows that exercise can help to expend additional calories so that she can maintain energy balance and avoid gaining weight. She makes a goal to expend about 300 calories each day through exercise. She has already expended 217 calories during her run on the treadmill. If she maintains a moderate pace, she can expend 455 calories per hour on the stationary bike. How many minutes does Alissa need to ride the stationary bike in order to bring her exercise total to at least 300 calories?
   - Write an inequality that could be used to calculate the number of minutes Alissa should ride the stationary bike.
   - Solve this inequality, and graph the solution set on a number line.
   - Name at least three different solutions that are represented by your graph.

Assessment Questions

- How would the number of cups of popcorn change if Alissa had already consumed 1,900 calories?
- How would the time on the bike change if Alissa had only expended 142 calories on the treadmill?
Appendix D

Lori Hughes

Note: This tool has been adapted from the Next Generation Science Standards Lesson Screener to fit Virginia Standards of Learning.

A. Explaining Phenomena or Designing Solutions

- Lesson includes clear and compelling evidence of the following:
  - The lesson focuses on supporting students to make sense of a phenomenon or design solutions to a problem.

- What was in the materials, where was it, and why is this evidence?

- Evidence of Quality:
  - [ ] None
  - [ ] Inadequate
  - [ ] Adequate
  - [X] Extensive

- Suggestions for improvement:

  use of temp. probe instead of thermometers

B. Virginia Standards of Learning

- Lesson includes clear and compelling evidence of the following:
  - The lesson helps students develop and use multiple content-appropriate elements of the Virginia standards of learning essential understandings, knowledge, and skills.

- What was in the materials, where was it, and why is this evidence?

  data analysis and application of concepts to different situations
  Students expected to apply correct knowledge to a similar but different problem
• Evidence of Quality:
  □ None
  □ Inadequate
  □ Adequate
  ☑ Extensive

• Suggestions for improvement:

  none

C. Integrating the Standards for Instruction and Assessment

• Lesson includes clear and compelling evidence of the following:
  o The lesson requires student performances that integrate elements of the Virginia
    Standards of Learning to make sense of phenomena or design solutions to problems, and
    the lesson elicits student artifacts that show direct, observable evidence of learning.

• What was in the materials, where was it, and why is this evidence?

  Data table as well as calculations and analysis shows student understanding of concepts

• Evidence of Quality:
  □ None
  □ Inadequate
  □ Adequate
  ☑ Extensive

• Suggestions for improvement:

  none
D. Relevance and Authenticity

- Lesson includes clear and compelling evidence of the following:
  - The lesson motivates student sense-making or problem-solving by taking advantage of student questions and prior experiences in the context of the students' home, neighborhood, and community as appropriate.

- What was in the materials, where was it, and why is this evidence?

  USE OF COMMON SNACK FOODS AS SAMPLE PROCEDURE MATERIAL LIST MAKES THE LAB RELEVANT TO TEENAGE AUDIENCE.

- Evidence of Quality:

  ☐ None

  ☐ Inadequate

  ☐ Adequate

  ☑ Extensive

- Suggestions for improvement:

  NONE

E. Student Ideas

- Lesson includes clear and compelling evidence of the following:
  - The lesson provides opportunities for students to express, clarify, justify, interpret, and represent their ideas (i.e., making thinking visible) and to respond to peer and teacher feedback.

- What was in the materials, where was it, and why is this evidence?

  STUDENTS WRITE THEIR OUTCOME IN A COMMONPLACE TO COMPARE, CONTRAST, AND DISCUSS OUTCOMES. FOLLOW IN ANALYSIS OPPORTUNITY TO COMPARE AND DISCUSS OTHER.
• Evidence of Quality:
  □ None
  □ Inadequate
  □ Adequate
  □ Extensive

• Suggestions for improvement:

F. Building on Students’ Prior Knowledge

• Lesson includes clear and compelling evidence of the following:
The lesson identifies and builds on students’ prior learning in all three dimensions in a way that is explicit to both the teacher and students.

• What was in the materials, where was it, and why is this evidence?

  specific vocabulary * prior knowledge listed prior to introduction. Clearly defines teacher expectations.

• Evidence of Quality:
  □ None
  □ Inadequate
  □ Adequate
  □ Extensive

• Suggestions for improvement:

  NONE
Appendix E

Instructional Lesson Review Tool: English

Note: This tool has been adapted from the Achieve EQuIP (Educators Evaluating the Quality of Instructional Products) English Rubric for Lessons & Units to fit Virginia Standards of Learning.

Part I: Alignment with Virginia Standards of Learning

The lesson aligns with the Standards of Learning and Curriculum Framework:

☑ Targets a set of grade-level English standards of learning.
☐ Includes a clear and explicit purpose for instruction.
☑ Selects text(s) that measure within the grade-level text complexity band and are of sufficient quality and scope for the stated purpose (e.g., presents vocabulary, syntax, text structures, levels of meaning/purpose, and other qualitative characteristics similar to grade-level essential knowledge, skills, and processes).

Summary of Observations and Suggestions for Improvement:

• add requirement of counterargument in written response (before conclusion)
• include rater for grading written response (I printed you an example that also has students score themselves!)
• SOLs = 10.5 (nonfiction) > sophomoric level

Rating: 3 2 1 0

Rating Scale:
3 – Meets most to all criteria
2 – Meets many of the criteria
1 – Meets some of the criteria
0 – Does not meet the criteria
Part II: Key Instructional Shifts

The lesson/unit addresses the following:

- **Reading Text Closely:** Makes reading text(s) closely, examining textual evidence, and discerning deep meaning a central focus of instruction.
- **Text-Based Evidence:** Facilitates rich and rigorous evidence-based discussions and writing about common texts through a sequence of specific, thought-provoking, and text-dependent questions (including, when applicable, questions about illustrations, charts, diagrams, audio/video, and media).
- **Writing from Sources:** Routinely expects that students draw evidence from texts to produce clear and coherent writing that informs, explains, or makes an argument in various written forms (e.g., notes, summaries, short responses, or formal essays).
- **Academic Vocabulary:** Focuses on building students’ academic vocabulary in context throughout instruction.

Summary of Observations and Suggestions for Improvement:

```
maybe add some additional questions that are not multiple choice (True/False, matching) based on the articles in academic vocabulary
```

Rating: 3 2 1 0

Rating Scale:
3 – Meets most to all criteria
2 – Meets many of the criteria
1 – Meets some of the criteria
0 – Does not meet the criteria
Part III: Instructional Supports

The lesson/unit is responsive to varied student learning needs:

☐ Cultivates student interest and engagement in reading, writing, and speaking about texts.
☐ Addresses instructional expectations and is easy to understand and use.
☐ Provides all students with multiple opportunities to engage with text of appropriate complexity for the grade level; includes appropriate scaffolding so that students directly experience the complexity of the text.
☐ Focuses on challenging sections of text(s) and engages students in a productive struggle through discussion questions and other supports that build toward independence.
☐ Integrates appropriate supports in reading, writing, listening and speaking for students who are ELL, have disabilities, or read well below the grade level text band.
☐ Provides extensions and/or more advanced text for students who read well above the grade level text band.

Summary of Observations and Suggestions for Improvement:

Rating: 3 2 1 0

Rating Scale:
3 – Meets most to all criteria
2 – Meets many of the criteria
1 – Meets some of the criteria
0 – Does not meet the criteria

underline or bold "environment" within the article for easier finding to answer question #2

they could also make a Venn diagram on the back of the compare/contrast map (as an additional graphic organizer)
Part IV: Assessment

The lesson regularly assesses whether students are mastering standards-based content and skills:

- Elicits direct, observable evidence of the degree to which a student can independently demonstrate the major targeted grade-level Virginia standards of learning with appropriately complex text(s).
- Assesses student proficiency using methods that are unbiased and accessible to all students.
- Includes aligned rubrics or assessment guidelines that provide sufficient guidance for interpreting student performance.

Summary of Observations and Suggestions for Improvement:

Rating: 3  2  1  0

Rating Scale:
3 – Meets most to all criteria
2 – Meets many of the criteria
1 – Meets some of the criteria
0 – Does not meet the criteria
Appendix F

Instructional Lesson Review Tool: Math

Note: This tool has been adapted from the Achieve EQuIP (Educators Evaluating the Quality of Instructional Products) Mathematics Rubric for Lessons & Units to fit Virginia Standards of Learning.

Part I: Alignment with Virginia Standards of Learning

The lesson aligns with the Standards of Learning and Curriculum Framework:

- Targets a set of grade/content-level science standard(s) to the full depth of the standards including essential understandings, knowledge and skills found in the curriculum framework.
- Standards that are central to the lesson are identified, handled in an appropriate way, and well connected to the content being addressed.
- Presents a balance of mathematical procedures and deeper conceptual understanding.

Summary of Observations and Suggestions for Improvement:

Rating: 3 2 1 0

Rating Scale:
3 – Meets most to all criteria
2 – Meets many of the criteria
1 – Meets some of the criteria
0 – Does not meet the criteria
Part II: Key Instructional Shifts

The lesson reflects evidence of the following:

- Focus: Lessons and units targeting the major work of the grade provide an especially in-depth treatment, with especially high expectations. Lessons and units targeting supporting work of the grade have visible connection to the major work of the grade and are sufficiently brief. Lessons and units do not hold students responsible for material from later grades.
- Coherence: The content develops through reasoning about the new concepts on the basis of previous understandings. Where appropriate, provides opportunities for students to connect knowledge and skills within or across clusters, domains and learning progressions.
- Rigor: Requires students to engage with and demonstrate challenging mathematics with appropriate balance among the following:
  - Application: Provides opportunities for students to independently apply mathematical concepts in real-world situations and solve challenging problems with persistence, choosing and applying an appropriate model or strategy to new situations.
  - Conceptual Understanding: Develops students' conceptual understanding through tasks, brief problems, questions, multiple representations and opportunities for students to write and speak about their understanding.
  - Procedural Skill and Fluency: Expects, supports and provides guidelines for procedural skill and fluency with core calculations and mathematical procedures (when called for in the standards for the grade) to be performed quickly and accurately.

Summary of Observations and Suggestions for Improvement:

This is an excellent illustration of how this math can relate to other subjects. Allowing the students the freedom to identify their own problem and collect their own data would be an interesting addition and challenge for them.

Rating: 3 2 1 0

Rating Scale:
3 – Meets most to all criteria
2 – Meets many of the criteria
1 – Meets some of the criteria
0 – Does not meet the criteria

Part III: Instructional Supports

The lesson/unit is responsive to varied student learning needs:

☐ Includes clear and sufficient guidance to support teaching and learning of the targeted standards, including, when appropriate, the use of technology and media.

☐ Uses and encourages precise and accurate mathematics, academic language, terminology and concrete or abstract representations (e.g., pictures, symbols, expressions, equations, graphics, models) in the discipline.

☐ Engages students in productive struggle through relevant, thought-provoking questions, problems and tasks that stimulate interest and elicit mathematical thinking.

☐ Addresses instructional expectations and is easy to understand and use.

☐ Provides appropriate level and type of scaffolding, differentiation, intervention and support for a broad range of learners.
  o Supports diverse cultural and linguistic backgrounds, interests and styles.
  o Provides extra supports for students working below grade level.
  o Provides extensions for students with high interest or working above grade level

Summary of Observations and Suggestions for Improvement:

Rating:  3  2  1  0

Rating Scale:
3 – Meets most to all criteria
2 – Meets many of the criteria
1 – Meets some of the criteria
0 – Does not meet the criteria
Part IV: Assessment

*The lesson regularly assesses whether students are mastering standards-based content and skills:*

- ☐ Is designed to elicit direct, observable evidence of the degree to which a student can independently demonstrate the targeted standard.
- ☐ Assesses student proficiency using methods that are accessible and unbiased, including the use of grade-level language in student prompts.
- ☐ Includes aligned rubrics, answer keys and scoring guidelines that provide sufficient guidance for interpreting student performance.

**Summary of Observations and Suggestions for Improvement:**


Rating:

3 2 1 0

Rating Scale:
3 – Meets most to all criteria
2 – Meets many of the criteria
1 – Meets some of the criteria
0 – Does not meet the criteria

Overall Rating: 3
## Persuasive Essay Rubric

<table>
<thead>
<tr>
<th>AREA</th>
<th>CRITERIA</th>
<th>SCORE</th>
<th>Student Score for Each Area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction</strong></td>
<td>Includes a hook to get the reader's attention.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Background info provided. <em>(optional)</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Opinion statement is clear.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>First Argument</strong></td>
<td>Topic sentence states the evidence.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elaboration to back the evidence is clear and persuasive.</td>
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<td></td>
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<tr>
<td><strong>Second Argument</strong></td>
<td>Topic sentence states the evidence.</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Elaboration to back the evidence is clear and persuasive.</td>
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<td></td>
</tr>
<tr>
<td><strong>Third Argument</strong></td>
<td>Topic sentence states the evidence.</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Elaboration to back the evidence is clear and persuasive.</td>
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</tr>
<tr>
<td><strong>Fourth Argument</strong></td>
<td>Topic sentence states the evidence.</td>
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<td></td>
</tr>
<tr>
<td><em>(optional)</em></td>
<td>Elaboration to back the evidence is clear and persuasive.</td>
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<tr>
<td><strong>Opposing Viewpoint</strong></td>
<td>Topic sentence states the opposing view.</td>
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<td></td>
<td>Rebuttal evidence is clear and makes sense.</td>
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<tr>
<td></td>
<td>Elaboration to back the rebuttal is clear and persuasive.</td>
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</tr>
<tr>
<td><strong>Conclusion</strong></td>
<td>Paraphrases main points.</td>
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<tr>
<td></td>
<td>Restates opinion statement.</td>
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<td></td>
<td>Includes personal comment or a call to action.</td>
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<td></td>
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<tr>
<td><strong>Mechanics</strong></td>
<td>Sentences make sense.</td>
<td></td>
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<tr>
<td></td>
<td>Spelling is correct.</td>
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<tr>
<td></td>
<td>Capitalization and punctuation (space after punctuation!) are correct.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Word usage and transition signals make sense.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[http://www.scholastic.com/flashlight](http://www.scholastic.com/flashlight)