

The Energy Equation (1 hour, 40-50 minutes, including homework)

Section

Food and Nutrition, Your Body, Physical Activity

Investigative Questions

How can food, sleep, and physical activity (exercise) choices affect energy levels? What are some of the barriers that keep people from making healthy food choices, getting adequate sleep, and participating in physical activity regularly? How can these barriers be overcome?

Description of Content

Most kids (and most adults) understand the need to make healthy food choices, get enough sleep, or participate in physical activity regularly. But people do not always base their actions on what they know. One of the challenges of the Centers for Disease Control and Prevention (CDC) is to help people translate health information into action.

In this activity, students review the components of the Energy Equation: Food + Sleep + Physical Activity = Energy. They think about the barriers to and benefits of acting on each component of the equation. Finally, students develop a plan for putting their health knowledge into practice.

Relevant Standards

This activity fulfills [science and health education standards](#).

Objectives

Students will:

- Research the need for the recommended nutrition, sleep, and physical activity to have optimal energy by playing several interactive games on the *BAM! Body and Mind*TM Web site
- Analyze the barriers to and benefits of eating right, getting enough sleep, and participating in physical activity for students their age
- Translate their research into action by developing a motivational/educational piece on one of the topics that helps overcome the barriers they have discussed

Ideas and Behaviors Common Among Students

This activity offers information from the literature on [ways your students may already think and act](#) with respect to nutrition, sleep, and physical activity.

Materials

- A computer with Internet access
- Copies of Student Reproducible: *Scoring Rubric*

Safety

Observe normal classroom safety procedures for this module.

Teacher Background

Nutrition, sleep, and physical activity are key components of a healthy and active lifestyle.

According to the United States Department of Agriculture, kids need a balance of fruits and veggies, lean protein and dairy, and whole grains. Only 2 percent of children meet all of the recommendations—for example, less than 20 percent eat the recommended serving of fruits and vegetables, about 25 percent eat the recommended servings of grains, and 30% consume the recommended servings of dairy. Good nutrition not only increases energy, but also can increase your students' ability to cope with stress.

Healthy eating includes water consumption. Water helps the body take nutrients to cells, assists the body in getting rid of waste, cleanses the system, and keeps you from feeling dizzy, light-headed, and tired. According to the Institute of Medicine, kids 9 to 13 need between 2 and 2.5 liters of water per day (8-10 cups), including water in other beverages and foods—and more if they are active. Students may prefer sweet drinks such as soda, but these may contain non-nutritional calories, caffeine, or both.

According to the National Sleep Foundation, kids who are 5 to 12 years old need about 10 or 11 hours of sleep a night, but get 9.5 on average. As kids get older, their body clocks change. Teens need a little more than 9 hours of sleep a night, but on average get less than 8. When kids do not get enough sleep, they are not only tired, but have trouble thinking clearly, completing complex tasks, and enjoying everyday life. According to the National Institutes of Health, insufficient sleep is associated with reduced short-term memory and learning ability, negative mood, inconsistent performance, poor productivity, and loss of some forms of behavioral control. (It's not just kids who benefit from a good night's sleep! Adults need 7 to 9 hours of sleep per night, but the average American adult gets the 7-hour minimum on weekdays.)

Kids between 9 and 13 years old should try to be active for about an hour a day, 5 or more days a week. A CDC survey showed that 61.5 percent of children aged 9 to 13 years do not participate in any organized physical activity during their nonschool hours and that 22.6 percent do not engage in any free-time physical activity. Also, many schools lack physical activity requirements, especially in higher grades. In addition to physical health benefits, regular physical activity may reduce feelings of depression and anxiety while promoting psychological well-being. Also, recent research has also shown a possible correlation between higher levels of fitness and higher academic achievement in reading and math. Finally, studies have shown that the old adage is true—keeping kids busy keeps them out of trouble. Kids who are physically active are less likely to engage in risky behaviors such as smoking, drinking alcohol, substance abuse, and sexual behaviors.

Procedure

Engagement (10 minutes)

1. Ask students to tell you some formulas they remember. They may include Density = Mass/Volume, or the formula to find the area of a rectangle:
 $A = L \times W$.
2. Ask students to tell you what a formula does. (It's a rule that defines how things are to be done—a standard process. Another definition of a formula is “a recipe.”)
3. Have students keep those definitions in mind as you write the following formula on the board:

$$\text{Food} + \text{Sleep} + \text{Physical activity} = \text{Energy}$$

4. Ask your students what they think this formula means. As students “solve” the equation, make these points:
 - Food and water, sleep, and physical activity are all ingredients in a high-performance equation. **Each part is critical to the success of the overall equation.**
 - The foods students eat can affect their mood, their ability to handle stress, and their academic and physical performance each day. Empty calories provide less value to the body. Eating right and drinking enough water provide energy and good health.
 - Sleep plays an important role in renewing the body's energy levels. It also plays a role in growth and development. Sleep affects the mind as well, including how kids feel, think, and learn. Preteen and teenagers' bodies and minds are growing, which is why they need more sleep than adults.
 - Physical activity is a key component of maintaining energy. In fact, fitness is as important as food. It reduces feelings of depression and stress and promotes confidence. It also aids academic achievement. The goal is a healthy body that is fine tuned to perform at its peak. Each person's best is different from everyone else's.

Exploration (10 to 20 minutes per student)

1. Have students go to the Your Body section of the *BAM! Body and Mind*TM Web site at www.bam.gov/sub_yourbody/index.html and play the Pillow Pitch, Picnic Pickup, and Jumble Jim interactive games. This can be done in school or at home. Once they have played all three interactive games, have them write down brief descriptions of what they enjoyed and what they learned from each game.

2. Ask which part of the energy equation is the toughest for them to follow. (In other words, is it hardest to choose nutritious foods/drink water, get enough sleep, or get regular physical activity?) Ask students to take out a piece of paper and rank them 1, 2, and 3, with 1 being the most difficult, and 3 being the easiest.

_____ Eating right/Drinking water

_____ Getting enough sleep

_____ Getting enough physical activity (exercise)

Explanation (20 minutes)

1. Tell students you are going to conduct a quick classroom poll based on their answers. Ask students to report their own rankings.
 - How many said eating right/drinking water was the toughest? (write answers on the board)
 - How many said getting enough sleep was hardest? (write answers on the board)
 - How many said getting enough physical activity was the most challenging? (again, write answers on the board)
2. Now, have students speculate. Why do they think the class got these results?
3. In this discussion, have students identify the *barriers* to each of the healthy behaviors. What are things that keep them from eating right/drinking water? Getting enough sleep? Participating in physical activity regularly? Here are some possible responses:

Food/Water: Family is busy and rarely has time for family meals; don't know enough about nutrition; don't like the food in the cafeteria so eat high-fat snacks from the vending machines; hard to resist something that looks and tastes good; sugary drinks give quick energy and/or taste better than water.

Sleep: Have a busy schedule and need to stay up late; watch TV or play video games until late; drink caffeine; school starts too early in the morning.

Physical Activity: Don't have time; don't like it; their friends don't do it; aren't a good athlete; have too much to do with school and other activities; don't have a place to participate; don't have gym class at school.

Put students' answers on the board.

4. Now have them list the *benefits* to these behaviors that they and other kids their age value (e.g., looking good, being strong, getting good grades, reducing stress).

Elaboration (30 minutes or longer)

1. Divide your students into groups of three or four. Explain that they are now professional health educators whose job it is to develop campaigns to improve people's health. (Campaigns are a series of messages, advertisements, and events to communicate a product, idea, or movement.) Remind students that they have seen advertising campaigns on television, and also may have seen or heard public service announcements (PSAs), which might promote anything from not smoking to the importance of buckling safety belts to prevent traffic deaths.
2. In addition to PSAs on television, there are also PSAs in newspapers, in magazines, on billboards, and on the radio. Many groups also develop materials for use in schools (think of the anti-smoking materials you may have seen in a health class), sponsor runs or walks for a cause, and any other kind of activity they think will make people listen to their message and actually take action for better health. Ask students to mention other health campaigns they have seen or perhaps even participated in.
3. Through this activity, help students realize that it's hard work to get people to have healthy attitudes and behavior. For example, in spite of information about the health risks of being overweight, people may still continue to choose unhealthy food and reject physical activity.
4. Point out to students that before developing a health campaign, health educators first do research to see what barriers people face in adopting a healthy attitude or behavior. They also research the benefits of the healthy attitude or behavior. They concentrate on a select group of people (for example, students in middle school), instead of the general population, so that the campaign they develop is truly tailored for those people. They read articles on this particular group, observe them, and/or ask them questions—such as why they don't buckle their safety belts, why they started drinking alcohol, or why they don't stop smoking.
5. The discussion they just held identified those barriers and benefits for the three components of the Energy Equation: Food, Sleep, and Physical Activity. They have the class "data" before them on the board.
6. Their job is to work with the other members of their group on one of the three components of the Energy Equation. They should prepare a short skit, print ad, or mock TV or radio ad that promotes their health message to one specific audience—kids their age. First, they should review and possibly expand the list of barriers and benefits with their small group. Then they should develop their skit to address at least one of those barriers with the benefits needed to "sell" the healthy behavior to the class. They can use songs or humor, or they can do

something very serious. They can also use the content on the *BAM! Body and Mind*TM Web site (the games or information) to help them come up with good message points. Students may want to review the Web content again before creating their health messages.

Evaluation (30 minutes)

1. Have student groups present their health education piece. Their presentation should explain the barriers they tried to overcome, and the benefits they used, in their pieces.

Performance Descriptors

Have students complete the student reproducible, *Scoring Rubric*.

Extension

1. Many barriers people face cannot be addressed by a communication piece such as a PSA alone. Many require changes in policies or rules. For example, if students pick physical activity as their topic to address, they may have heard that for some kids there is no safe place to be active after school. Students should describe a strategy to overcome that barrier, such as extending access to school or youth center facilities after hours for students to play sports or just be physically active.

Web Resources

Centers for Disease Control and Prevention (CDC): www.cdc.gov

CDC *BAM! Body and Mind*TM: www.cdc.gov/bam or www.bam.gov

BAM! Body and Mind is brought to you by the Centers for Disease Control and Prevention (CDC), an agency of the U.S. Department of Health and Human Services (DHHS). *BAM!* was created to answer kids' questions on health issues and recommend ways to make their bodies and minds healthier, stronger, and safer. *BAM!* also serves as an aid to teachers, providing them with interactive activities to support their health and science curriculums that are educational and fun.

CDC Division of Adolescent and School Health (DASH)

Healthy Schools, Healthy Youth: www.cdc.gov/HealthyYouth/index.htm

This site provides descriptions of DASH's initiatives to prevent the most serious health risk behaviors among children, adolescents, and young adults. You can find information on specific health topics that affect youth, data and statistics, and details on school health programs. The site also offers brochures for parents, teachers, and principals on promoting physical activity at www.cdc.gov/healthyyouth/physicalactivity/brochures/index.htm.

CDC VERB™ Youth Media Campaign: www.cdc.gov/verb

This site includes materials for kids and adults associated with the VERB™ campaign, which encourages young people ages 9-13 years to be physically active every day. You can also find research and statistics on youth, physical activity, media, and the campaign itself.

VERB™ Youth Web Site: www.VERBnow.com

This Web site includes resources and information to make regular physical activity “cool” for tweens and a fun thing to do. For example, students can enter their zip code and the sport they want to play and the site will provide them with a list of places they can play.

VERB™ Parent Web Site: www.VERBparents.com

This Web site aims to raise awareness and provide long-term strategies to help parents of kids ages 9-13 in their efforts to improve their family's physical activity and nutrition habits.

CDC *Powerful Bones. Powerful Girls.*: www.cdc.gov/powerfulbones/parents/index.html

A site designed for parents that provides useful information on how to help girls develop lifelong bone-healthy habits, including tips on nutrition and physical activity. Links to the campaign's award-winning Web site for girls.

American Academy of Pediatrics (AAP): www.aap.org

Overweight and Obesity: www.aap.org/healthtopics/overweight.cfm

This is a comprehensive site for parents, educators, and health professionals that deals with a variety of issues related to overweight and obesity in young people. Other sections of the AAP Web site include links to information about the health benefits of physical activity.

KidsHealth: www.kidshealth.org

This site provides information for both kids and adults on nutrition, sleep, and physical activity.

National Sleep Foundation: www.sleepfoundation.org

Teens and Sleep:

www.sleepfoundation.org/hottopics/index.php?secid=18&id=189

A fact sheet on teens and sleep that includes the health benefits of sleep and specific suggestions on how teens can get the sleep they need. Other links on this site include research about teens and sleep problems.

The President's Council on Physical Fitness and Sports: www.fitness.gov

The Council promotes fitness and physical activity for people of all ages. It places a special emphasis on overcoming barriers to physical activity—particularly for people with disabilities. The Web site offers links to resources and information on the President's Challenge, a program that encourages all Americans to make being active part of their everyday lives and offers Presidential awards for daily physical activity and fitness efforts.

Text Correlations

Glencoe/McGraw-Hill, *Science Probe I*, Chapter 10, Fitness and Health: A Way of Life

Glencoe, *Science Voyages*, Chapter 19, Nutrients and Digestion

Glencoe, *Teen Health Course 1*, Chapter 1, Living a Healthy Life; Chapter 5, Nutrition and Physical Activity

Glencoe, *Teen Health Course 2*, Chapter 3, Physical Activity and Fitness; Chapter 4, Food and Nutrition; Chapter 7, Mental and Emotional Health

Glencoe, *Teen Health Course 3*, Chapter 8, Nutrition for Health; Chapter 9, Physical Activity and Fitness

Relevant Standards

National Science Education Standards

Content Standard F, Grades 5-8: Life Science

Science in Personal and Social Perspectives:

- Regular exercise is important to the maintenance and improvement of health. The benefits of physical fitness include maintaining healthy weight, having energy and strength for routine activities, good muscle tone, bone strength, strong heart/lung systems, and improved mental health. Personal exercise, especially developing cardiovascular endurance, is the foundation of physical fitness.
- Food provides energy and nutrients for growth and development. Nutrition requirements vary with body weight, age, sex, activity, and body functioning.

Benchmarks for Science Literacy

By the end of 8th grade, students should know that:

Chapter 6, Benchmark E, Grade 6-8: Physical Health

Students should extend their study of the healthy functioning of the human body and ways it may be promoted or disrupted by diet, lifestyle, bacteria, and viruses. Students should consider the effects of tobacco, alcohol, and other drugs on the way the body functions. They should start reading the labels on food products and considering what healthful diets could be like.

- The amount of food energy (calories) a person requires varies with body weight, age, sex, activity level, and natural body efficiency. Regular exercise is important to maintain a healthy heart/lung system, good muscle tone, and bone strength.
- Toxic substances, some dietary habits, and some personal behavior may be bad for one's health. Some effects show up right away, others may not show up for many years. Avoiding toxic substances, such as tobacco, and changing dietary habits to reduce the intake of such things as animal fat increases the chances of living longer.

National Health Education Standards

Standard 1

Students will comprehend concepts related to health promotion and disease prevention:

- Explain the relationship between positive health behaviors and the prevention of injury, illness, disease and premature death.
- Describe the interrelationship of mental, emotional, social and physical health during adolescence.
- Explain how health is influenced by the interaction of body systems.
- Describe how family and peers influence the health of adolescents.
- Analyze how environment and personal health are interrelated.
- Describe ways to reduce risks related to adolescent health problems.

Standard 3

Students will demonstrate the ability to practice health-enhancing behaviors and reduce health risks.

- Explain the importance of assuming responsibility for personal health behaviors.
- Analyze a personal health assessment to determine health strengths and risks.
- Demonstrate strategies to improve or maintain personal and family health.
- Demonstrate strategies to manage stress.

Standard 6

Students will demonstrate the ability to use goal-setting and decision-making skills to enhance health.

- Demonstrate the ability to apply a decision-making process to health issues and problems individually and collaboratively.
- Analyze how health-related decisions are influenced by individuals, family, and community values.
- Predict how decisions regarding health behaviors have consequences for self and others.
- Apply strategies and skills needed to attain personal health goals.

Ideas and Behaviors Common Among Students

Food

- When teens are asked, they say that their cravings, taste of food, and convenience are some of the most important reasons for picking the food choices that they do. Many boys and girls say that they do not eat healthy foods, such as vegetables, because they are not worried about their health, it takes too much time to prepare these foods, or these healthy foods are not readily available (Neumark-Sztainer et al., 1999).
- When asked how to eat healthier, junior high school students in focus groups recommended “eating vegetables without butter,” “not eating a bunch of junk,” “not eating greasy or fattening foods,” and “limiting caffeine” as important methods. Many adolescents relate eating to energy and healthy growth, saying that good foods are “the stuff that will give you energy for the rest of the day” (Croll, Neumark-Sztainer, & Story, 2001).
- The more confident girls and boys are in their ability to eat healthy and be physically active, the more they are likely to have healthier habits (Vereecken, Van Damme, & Maes, 2005; Ievers-Landis et al., 2003; Strauss, 2001; Trost et al., 1999).
- Among 9 to 14-year-old children in a large research study, the strongest influence on whether they had concerns about their weight was the media, followed by parents and peers. In addition, those making a strong effort to look like same-sex figures in the media were more likely than their peers to develop weight concerns and become constant dieters (Field et al., 2001).
- In a study on media influence and body image of both adolescent boys and girls, girls said they were more concerned about their body size and shape and adopted more strategies to decrease weight and restrict eating practices, while boys were more concerned about muscle tone and adopted more strategies to increase weight (McCabe & Ricciardelli, 2001).

Sleep

- In addition to the distractions of television, video games, siblings, and the need to rebel against bedtime, sleep can be a problem for many children. Sleep problems in children include: insomnia, snoring, restless legs syndrome, nightmares and sleep

terrors, sleep walking and sleep talking, and bed wetting (National Sleep Foundation, 2004).

- In focus groups asking about outside activities, many teenagers said that they like to sleep when they get out of school in the afternoon (Community Services Planning Council, 2001).
- Many adolescents will try to catch up on much-needed sleep during the weekends, with teens averaging 1 hour and 50 minutes more sleep on weekend nights than weekday nights (National Sleep Foundation, 2000).
- Adolescents also show differences in sleep patterns in relation to their stage of puberty. Among sixth-grade girls, those who were less developmentally advanced favored earlier bedtime hours, while those in later stages of puberty preferred later hours (Carskadon, 1999).
- Students who work 20 hours per week or more reported later bedtimes, shorter sleep times, more frequent episodes of falling asleep in school, and more frequent oversleeping and arriving late at school than students who do not work as many hours outside of school (Carskadon, 1999).

Physical Activity

- As they move from junior high school to high school, girls are more likely than boys to take on more negative attitudes about physical activity and report that there are fewer physical activity role models for them (Garcia et al., 1998).
- Pre-teen girls participate in physical activity primarily “to have fun,” followed by (in order of occurrence) “to stay in shape,” “I like it,” and “to learn new skills.” Girls who do not report participating regularly in physical activity demonstrate much less knowledge about the benefits of physical activity than do regular participants (Kientzler, 1999).
- Boys perceive the physical domain as the most important (more important than academic and social) in terms of displaying competence (Eccles and Harold, 1991).
- Some of the barriers to boys’ and girls’ physical activity include excessive TV viewing, video or computer game playing, lack of accessibility to safe areas, lack of availability of sports activities at school, and lack of transportation (Bungum & Vincent, 1997; Gordon-Larsen et al., 1999).
- While many 9 to 13-year-olds have found activities they are good at, some say they have not. According to these kids, they have not found a specific extracurricular activity they really enjoy and want to stick with. Therefore, these kids indicate that they don’t participate in many activities or say they are likely to quit if given the chance (CDC, 2001).

- Feeling supported by both parents and friends helps increase pre-teens' amount of physical activity. In addition, knowledge of physical activity also is important for girls, whereas boys' interest in sports media increases the amount they are physically active (DiLorenzo et al., 1998).
- When asked why they exercise, 9 to 16-year-olds were likely to say that their physical activity was an "effort to look like figures in the media." The media's influence on adolescent exercise was stronger among older boys and girls than younger ones (Taveras et al., 2004).

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Student Reproducible:

Scoring Rubric

Directions: As you watch each group present their short skit, print ad, or mock TV or radio ad, score the presentation from 0 to 5 points in each of the following categories:

Category	Total Points (out of 5)
The group based its piece (short skit, print ad, or mock TV or radio ad) on their research on barriers and benefits.	_____
The health message of the piece was clear. People our age who saw the piece would be able to restate the basic message.	_____
The piece was based on information found on the <i>BAM!</i> Web site.	_____
The group's piece would appeal to students our age.	_____
The piece would motivate students to try to change their health behavior.	_____
Total Points (Maximum 25)	_____