How Health Habits Improve Your Grades
Lesson Plan

Subject Area: Science and Math

Grade Level: Grades 6-8

Lesson Summary:
Students engage in an interactive project to see if physical activity, sleep habits and healthy eating can affect math test scores. Using guided questions, hands-on activities, and group discussions, students investigate how physical activity affects mental functioning. Students also analyze the metabolism of food as one aspect of how health habits influence mental functioning, measured as math scores.

Lesson Duration: Up to two class periods (90 minutes)

Essential Questions:
- How do health habits affect math test scores?
- What is the relationship between health habits and math scores?

Objectives:
Students will:
- Analyze the effects of health habits on math test scores
- Calculate statistics based on math test scores and tracking of health habits
- Analyze the metabolism of food
- Create a report to communicate their findings on the relationship between math scores and health habits

Standards:
National Physical Education Learning Standards
- Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness.
   - S3.M6.6 Participates in moderate to vigorous aerobic physical activity that includes intermittent or continuous aerobic physical activity of both moderate and vigorous intensity for at least 60 minutes per day.
   - S3.M16.8 Designs and implements a program to improve levels of health-related fitness and nutrition.
- Standard 4: The physically literate individual exhibits responsible personal and social behavior that respects self and others.
   - S4.M2.8 Uses effective self-monitoring skills to incorporate opportunities for physical activity in and outside of school.
- Standard 5: The physically literate individual recognizes the value of physical activity for health, enjoyment, challenge, self-expression, and/or social interaction.
   - S5.M2.8 Analyzes the empowering consequences of being physically active.

Next Generation Science Standards
- MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.
- MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

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ELA Common Core State Standards
- RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- WHST.6-8.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
- WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

Math Common Core State Standards
- MP.2 Reason abstractly and quantitatively.
- MP.4 Model with mathematics.

Materials
- **Physical Activity Log**
- **Sleep Log**
- **Fruit and Vegetable Consumption Log**
- **Class Data Analysis Worksheet**
- **NSTA: Peer-review sheet used by students during the double-blind peer review**
    - https://www.nsta.org/highschool/connections/200911PeerReviewSheet.pdf
- Computer with Internet access

Preparation
- Create two math tests of equal difficulty, but using different questions to cover the same computational skills. You may wish to use a test generator (see Additional Resources) to create similar tests of equal levels of difficulty. Depending on the skill level of your students, aim for tests with 50-100 questions, and give a time limit of five minutes for the test. The aim is not for students to complete all the questions within the time limit. The math questions are very simple, so the aim is to create quizzes that generate significant variation among students and that cannot be easily memorized.
- Brainstorm with students a list of healthy food options that students can eat to help prepare them for their school days/tests and to create their own daily "meal plan."

Procedure:

ENGAGE
1. Ask students to write down on a scale of 1 to 5 how important good health is to them, where 1 is not at all important and 5 is very important.

2. Ask students to write on a scale of 1 to 5 how much they enjoy math, where 1 is do not enjoy at all and 5 is enjoy very much.

3. Ask students to subtract the second number from the first.

4. Ask students to think about the result of the subtraction. For example, a number greater than zero could indicate that good health is important but they student may not enjoy math.

5. Ask students to consider if they'd enjoy math more if they could improve their math skills.

6. Explain to students that they will conduct an investigation into whether adopting health habits could improve their math scores in tests.

EXPLORE
1. Present to students the guiding question, "Do health habits affect math test scores?"

2. Students individually complete the first math test. Explain that they will be using these test results as a baseline and will take another test later and compare the scores. Assure students the scores will not be entered into the grade book and are only for the purposes of this investigation.

3. Score students' tests. (If you prefer, use the double-blind system to allow students to score each other's tests). (If necessary provide test solutions.) Allow time for accurate grading and recording of scores.

4. Students record the pre-activity math test scores in their worksheets.

5. Students select a health habit to record for one week: physical activity, sleep habits, or fruit and vegetable consumption.

6. Students complete the worksheet with their three-day recall for their selected health habit, including calculation of the daily average for the activity.

7. Students explore online to learn more about the benefits of their selected healthy habit.

8. Provide students with the recommendation for the selected health habit:
   - At least 60 minutes of physical activity daily
   - 9 to 11 hours of sleep per night[1]
   - 1.5 cups of fruit and 2 (female) or 2.5 (male) cups of vegetables per day

9. Students track their selected health habit for one week, striving to meet the recommendation.

10. After a week, students calculate of the daily average for the activity.

11. Administer the second test under the same conditions as the first (Step 2). Ensure that the test level and testing conditions are as similar as possible to the first test. (Do not, however, administer exactly the same test!)

12. Grade tests as before.

13. Students complete their worksheets with the post-activity math score.

14. Use a smart board or on-line collaboration tool to organize and summarize student data.

15. Students work in pairs or small groups to analyze the class data using their worksheets.

EXPLAIN
1. Review the guiding question, "Do healthy habits affect math test scores?"

2. Students work in their pairs or groups to develop answers to the guiding question. Ensure groups focus on explaining the connection between physical activity and math scores.

3. Lead a class discussion of the core idea that physical activity benefits mental functioning. Encourage students to consider the idea that math tests are just one example of mental functioning.

4. Encourage groups to consider ways to improve the investigation based on scientific inquiry.

5. Each group creates a visual graphic organizer (e.g., concept map, slide presentation, research poster) to present their findings. To reduce overlap, allow each group to choose (or assign) one of the three health habits for their presentation.

6. Groups present their graphic organizers, along with explanations of how their chosen health habit relates to math scores.

16. Use a smart board or on-line collaboration tool to organize and summarize group presentations.

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[1] National Sleep Foundation's updated sleep duration recommendations: final report
http://www.sleephealthjournal.org/article/S2352-7218(15)00160-6/fulltext

ELABORATE

1. Students work in small groups to investigate the basis of physiological changes during physical activity. Provide students the following concepts:
   - Metabolism
   - Nutrients
   - Food energy
   - Work energy

2. Challenge students to discover the connection between these concepts. Groups can research online to develop a model of energy transformation. Encourage students to develop a hypothesis to explain the adage: "We are what we eat." If needed, ask guiding questions such as, "How are the components of food rearranged through chemical reactions to form new molecules, which are incorporated into the body?" and "How does the availability of food is a resource affect the health of the organism?"

3. Students create a concept map to explain their hypothesis. If time allows, advanced students can include flow charts that describe how food affects body systems and hence impacts mental functioning.

EVALUATE

1. Each student works individually to write an investigative report based on the activity and their explanations.

2. Students work in groups for double-blind peer review of reports. Provide each student a random number. Keep a list of each student's number. Students write their assigned numbers on their reports, but not their names.

3. Write all the numbers on a slip of paper. Each group pulls out a slip and reviews the paper that corresponds to that number. After completing their review, the group pulls out another slip and reviews the paper again.

4. Each group completes the information on the **NSTA Peer Review Sheet.**

5. Based on your key of student numbers, return the feedback to individual students.

6. Continue until all student papers are reviewed.

7. Students revise reports based on feedback then submit for evaluation. Ensure that the reports answer each of the lesson questions.

Additional Resources
- **The American Heart Association**
  - http://www.heart.org/kids
- **Physical Activity and the Health of Young People (Centers for Disease Control)**
  - http://www.cdc.gov/healthyyouth/physicalactivity/facts.htm
- **Nutrition and Health of Young People**
  - http://www.cdc.gov/healthyyouth/nutrition/facts.htm
- **How Much Sleep Do I Need?**
  - http://www.cdc.gov/sleep/about_sleep/how_much_sleep.htm
- **Create Math Tests**
  - http://www.rbechtold.com/math.html
- **NSTA: Peer-review sheet used by students during the double-blind peer review**
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FOLLOW-UP
- The key points of this lesson will be reinforced if students repeat their exploration with a different health habit over following weeks. For instance, if they chose to track physical activity in the first week, they could track fruit and vegetable consumption the second week and sleep in the third week.

Physical Activity Log

Student Name: _____

Part 1: Think about how often you have engaged in physical activity or exercise over the last three days. Using the chart below, describe your level of physical activity for the <u>last three days</u>.

	Activities	Time (minutes)
Day One		
Day Two		
Day Three		

Average number of minutes per day you participated in physical activity during the past three days: _____

Part 2: Using the chart below, describe your level of physical activity for the week of this investigation.

	Activities	Time (minutes)
Sunday		
Monday		
Tuesday		
Wednesday		
Thursday		
Friday		
Saturday		

Average number of minutes per day you participated in physical activity during the week _____

Pre-Investigation Math Score_____   **Post- Investigation Math Score**_____

Sleep Log

Student Name: _____

Part 1: Record the number of hours you slept each night over the past three days.

	Hours of Sleep
Day One	
Day Two	
Day Three	

Average number of hours per night you slept during the past three days: _____

Part 2: Record the number of hours you slept each night during the week of the investigation.

	Hours of Sleep
Sunday	
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	

Average number of hours per night you slept during the week of the investigation: _____

Pre-Investigation Math Score_____   **Post- Investigation Math Score**_____

Fruit and Vegetable Consumption Log

Student Name: _____

Part 1: Record the number of cups of fruits and vegetables you ate over the past three days.

	Breakfast		Lunch		Dinner		Snacks	
	Fruit	**Veg**	**Fruit**	**Veg**	**Fruit**	**Veg**	**Fruit**	**Veg**
Day One								
Day Two								
Day Three								
Total								

Calculate the daily average number of cups of fruits and vegetables you ate over the past three days

Fruit: _____ **cups**   **Vegetables:** _____ **cups**

Part 2: Record the number of cups of fruits and vegetables you ate each day for one week.

	Breakfast		Lunch		Dinner		Snacks	
	Fruit	**Veg**	**Fruit**	**Veg**	**Fruit**	**Veg**	**Fruit**	**Veg**
Sunday								
Monday								
Tuesday								
Wednesday								
Thursday								
Friday								
Saturday								
Total								

Calculate the daily average number of cups of fruits and vegetables you ate for one week:

Fruit: _____ **cups**   **Vegetables:** _____ **cups**

Pre-Investigation Math Score_____   **Post- Investigation Math Score**_____

Class Data Analysis Worksheet

Student Name: _____

1. Based on your own data, what is your hypothesis for the effect of participating in a health habit on math scores?

_____

_____

_____

2. Complete the table with the averages for class data.

	Averages of Class Data			
	Physical Activity (minutes)	**Sleep (hours)**	**Fruits and Vegetables (cups)**	**Math Test Scores**
Pre-Investigation				
Post Investigation				

3. Do the class data support or refute your hypothesis? How?

_____

_____

4. Explain the importance of using the class data to test your hypothesis.

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