Introduction
Eliza Caldwell
Dr. Verplaetse
TSL 518
July 15, 2015

Title: The Science of Energy Balance, Calorie Intake and Physical Activity

Grade: 7-8

Modified for: ESL class

By: The National Institutes of Health with the National Institute of Diabetes and Digestive and Kidney Diseases


Pages: 43-59, 121-4


Images in Lesson 3 retrieved from: http://healthland.time.com/2012/09/05/can-you-be-fat-and-fit-or-thin-and-unhealthy/


I want my students to know that their activity level influences their health.
I want my students to know the language used to compare activity levels.
I want my students to know how to make healthy decisions regarding their activity levels.
### Content Objectives:
1. SWBAT evaluate the amount of energy required for different physical activities in pairs, then orally in a class discussion.
2. SWBAT Sequence and categorize their own physical activities through filling out a physical activity chart for one day.

### Language Objectives:
1. In a class discussion, students will orally categorize the amount of energy used in different physical activities.
2. After listening to the teacher’s explanation, students will record their own physical activity on a chart.

<table>
<thead>
<tr>
<th>Domain/Topic</th>
<th>Nearly Fluent Level 5</th>
<th>Expanding Level 4</th>
<th>Emerging Level 3</th>
<th>Early Production Level 2</th>
<th>Pre-Production Level 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speaking/In a full-class discussion, students will orally categorize the energy levels required for listed activities</td>
<td>Students will take leadership in evaluating the amount of energy required for listed activities, using complete sentences.</td>
<td>Students will evaluate the amount of energy required for listed activities, using phrases and short sentences.</td>
<td>Students will evaluate the amount of energy required for listed activities, using language prompts provided by the teacher.</td>
<td>Students will evaluate the amount of energy required for listed activities, using language prompts provided by the teacher or one-word responses</td>
<td>Students will evaluate the amount of energy required for listed activities, using single words or gestures.</td>
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<tr>
<td>Writing/Recording their daily activities into chart and calculating time spent doing each</td>
<td>Individually, students will record their activities for the school day on their charts and calculate time expenditures.</td>
<td>Students will complete the task of level 5, individually or paired with a level 3.</td>
<td>Students will be paired with a level 4 to complete the activity of level 5</td>
<td>With a level 2 partner, students will record their activities on the modified charts (no word bank).</td>
<td>With a partner, students will record their activities on the modified charts with a word bank.</td>
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<tr>
<td>Function</td>
<td>Situation</td>
<td>Expressions</td>
<td>Words</td>
<td>Grammar/ Discourse Structures</td>
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<td>Evaluate</td>
<td>Amount of energy required for activities</td>
<td>1. _____ requires a 2. _____ amount of energy</td>
<td>1. Running, walking, etc 2. Minimal, very small, small, moderate, large</td>
<td>1. Nominalization 2. Adjectives</td>
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<tr>
<td>Sequence</td>
<td>Their daily activity chart</td>
<td>At 1. _____, I 2. _____ for 3. _____ minutes.</td>
<td>1. 5:00, 6:00 2. Ran, walked 3. 30, 40, 50</td>
<td>1. Expressions of time 2. Simple past 3. Numbers up to 60</td>
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</table>
Lesson 1
Lesson 1

Main Lesson: Energy Balance: Calorie Intake and Physical Activity
Grade: 7-8
Lesson Time: 1 hour 15 minutes

Preparation
Level 1 and 2 students the given chart a day in advance so that they may review it. Seats are arranged in pairs.

Materials
Images of activities that will be difficult to draw simply on the board
Copy of Physical activity chart for each student (differentiated by level, found on p.7)
Transparency of blank sample activity chart (use level 3-5, found on p.
The following table, word box, and objectives are written on the board:

<table>
<thead>
<tr>
<th>Energy Requirements for Activities</th>
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<tbody>
<tr>
<td>Requires a MINIMAL amount of energy</td>
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<tr>
<td>Dancing</td>
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</tbody>
</table>

Initiation (7 mins):
1. Opener and Shared History Activity:
   a. Teacher writes “Why is exercise important?” Students think for one minute and share with their partner orally for two minutes.
   b. Teacher leads students in exercise:
      Do a popular dance (requires a MODERATE amount of energy)
      Run in place for 20 seconds (requires a LARGE amount of energy)
      Walk around desk 3 times (requires a SMALL amount of energy)
      Sit for 10 seconds (requires a VERY SMALL amount of energy)
      Sleep at desks for 10 seconds (requires a MINIMAL amount of energy)
2. Connecting Opener to Topic: (1 min) Teacher asks students “how did you do those activities?” She repeats all answers and indicates that energy allowed students to do those activities.

   Teacher can establish that all living things need energy, and the continuous use of energy differentiates living organisms from non-living ones.

Caldwell
Procedure:

3. **Explaining Energy Requirements (5 mins):**
   a. Teacher reads headings of columns and students chorally repeat.
   b. Teacher writes RUNNING in the LARGE AMOUNT column and models the following sentence orally and written on the board: “Running requires a large amount of energy.”
   c. Teacher indicates DANCING and asks “how much energy does dancing require?”
      *Dancing should be MODERATE. If students suggest dancing is LARGE, act out running hard versus dancing regularly, exaggerating the difference.
   d. Teacher asks how much energy each other activity requires, calling on individual students.

4. **Brainstorming (10 mins):**
   a. *Teacher instructs students (in pairs) to brainstorm activities that require energy.*
      Students write their ideas on a page in their notebooks.
      *Encourage students to list activities that aren’t strenuous, such as sleeping and sitting.
   b. Teacher underlines the “ing” in the examples of activities already given and instructs students to nominalize their verbs.

Written modifications to use during brainstorming:
Level 5: With a partner, students will take a leadership role in brainstorming and writing activities.
Level 4: With a partner, students will brainstorm and write activities.
Level 3: With a partner, students will brainstorm and write activities, seeking vocabulary assistance from level 4 and 5 students.
Level 2: With a partner, students will brainstorm and write activities, seeking vocabulary assistance from the teacher or other students.
Level 1: With a partner, students will brainstorm and write activities, using the word bank after the Physical Activity Chart (p. 9) for assistance.

5. **Evaluating energy requirements of activities (20):**
   a. Teacher asks a pair for an example activity they listed, for instance: riding a bike.
   b. Teacher demonstrates activity and models the following thinking for placing the activity in a column on the board: “does it require a large amount of energy, like running?” “No, it requires less energy than running” “does it require a moderate amount of energy, like dancing?” “Yes, it requires a moderate amount of energy”. Consider one level lower as well.
   c. Teacher asks for another example activity, for instance: watching TV, and asks the class “does it require a minimal amount of energy, like sleeping?” Class responds.
   d. Teacher asks for another example and a volunteer student to think aloud and categorize the activity.
Oral modifications to use during evaluating:
Level 5: Students will take leadership in evaluating the amount of energy required for listed activities, using complete sentences.
Level 4: Students will evaluate the amount of energy required for listed activities, using phrases and short sentences.
Level 3: Students will evaluate the amount of energy required for listed activities, using language prompts provided by the teacher. "_____ requires a ______ amount of energy”
Level 2: Students will evaluate the amount of energy required for listed activities, using language prompts provided by the teacher or one-word responses. "_____ requires a ______ amount of energy”
Level 1: Students will evaluate the amount of energy required for listed activities, using single words or gestures.

e. In pairs, students determine the amount of energy required for the activities they listed during Step 4. Teacher instructs students to write “minimal”, “very small” etc. next to the activity on their list.

f. A student volunteers to write on the board. Teacher asks a pair of students for an activity they brainstormed as well as its energy level. The format for answers will be “_____ requires a ______ amount of energy”

g. The rest of the class does thumbs up or thumbs down to indicate agreement or disagreement with the energy level.
   *There may be controversy over the energy levels for some activities. To demonstrate that some activities have different levels, two volunteers should come to the front and role play different energy levels. A great example is walking a dog. One student can walk a calm dog, while another can run after a very energetic dog.

6. Filling in Physical Activity charts (20 mins):
   a. Teacher gives each student a copy of the Physical Activity Chart (p. 7-9) and explains that students will record their activities for 24 hours on a school day and a weekend day.
   b. “I do”: Teacher displays a blank level 5 Physical Activity Chart on the overhead projector and models recording her activities for 7:00-8:00 that morning. If she slept for 10 minutes, ate for 10 minutes, and walked for 40 minutes, her chart will look like this:

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<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Minimal energy</th>
<th>Very small</th>
<th>Small</th>
<th>Moderate</th>
<th>Large</th>
<th>Total</th>
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<tr>
<td>7:00</td>
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c. “We do”: As a class, fill in the hour for that class period. Students can include the dancing and running in place.

d. “You do”: A student volunteers to fill in an hour on the overhead for their day.
e. Students record and categorize their activities for that day
*During this time, teacher informally assesses students’ comprehension of the lesson by observing them work on their charts. She can offer guidance as well.

**Modifications on Worksheets:**
Level 5: Students will record their activities for the school day on Level 5 charts (p. 7) and calculate time expenditures.
Level 4: Students will complete the Level 5 chart, individually or paired with a level 3 student.
Level 3: Students will complete the Level 5 chart paired with either a level 4 or level 3 student.
Level 2: Students will complete the Level 1 chart without the provided word bank, working with a fellow level 2 student.
Level 1: Students will record their activities on the Level 1 chart with the provided word bank. They will work with another level 1 student or with the teacher.

**Closure:**
1. *Teacher instructs students to fill in their chart for the rest of today.
2. *Teacher asks if there are any activities students do at home that haven’t been listed and as a group, clarify what amount of activity they require.*
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<th>Time</th>
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<td>6:00</td>
<td>Walk home chores, talk</td>
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<td>6:00</td>
<td>Homework</td>
<td>10:00</td>
<td>Homework</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6:00</td>
<td>Walk, walk to lunch</td>
<td>10:00</td>
<td>Walk, walk to lunch</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6:00</td>
<td>Math, walk to homework</td>
<td>10:00</td>
<td>Math, walk to homework</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6:00</td>
<td>Social Studies, walk to Math</td>
<td>10:00</td>
<td>Social Studies, walk to Math</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6:00</td>
<td>English, walk to Social Studies</td>
<td>10:00</td>
<td>English, walk to Social Studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6:00</td>
<td>Get dressed, walk to school, talk with friends</td>
<td>10:00</td>
<td>Get dressed, walk to school, talk with friends</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6:00</td>
<td>Sleep</td>
<td>5:00</td>
<td>Sleep</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6:00</td>
<td>Poker</td>
<td>5:00</td>
<td>Poker</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6:00</td>
<td>Homework</td>
<td>5:00</td>
<td>Homework</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6:00</td>
<td>Eat dinner, talk</td>
<td>5:00</td>
<td>Eat dinner, talk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6:00</td>
<td>Walk home chores, talk</td>
<td>5:00</td>
<td>Walk home chores, talk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6:00</td>
<td>Practise</td>
<td>5:00</td>
<td>Practise</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sample Physical Activity Diary for a School Day**

and indicate the number of minutes you spend on each of your physical activity (such as sleep, sitting, active, or light/moderate intensity activities).

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00</td>
<td>Sleep</td>
<td>10:00</td>
<td>Sleep</td>
</tr>
<tr>
<td>6:00</td>
<td>Poker</td>
<td>10:00</td>
<td>Poker</td>
</tr>
<tr>
<td>6:00</td>
<td>Homework</td>
<td>10:00</td>
<td>Homework</td>
</tr>
<tr>
<td>6:00</td>
<td>Eat dinner, talk</td>
<td>10:00</td>
<td>Eat dinner, talk</td>
</tr>
<tr>
<td>6:00</td>
<td>Walk home chores, talk</td>
<td>10:00</td>
<td>Walk home chores, talk</td>
</tr>
<tr>
<td>6:00</td>
<td>Practise</td>
<td>10:00</td>
<td>Practise</td>
</tr>
<tr>
<td>6:00</td>
<td>Science, talk, basketball practice</td>
<td>10:00</td>
<td>Science, talk, basketball practice</td>
</tr>
<tr>
<td>6:00</td>
<td>PE, walk to Science</td>
<td>10:00</td>
<td>PE, walk to Science</td>
</tr>
<tr>
<td>6:00</td>
<td>Music, walk to PE, class</td>
<td>10:00</td>
<td>Music, walk to PE, class</td>
</tr>
<tr>
<td>6:00</td>
<td>Eat, walk to Music</td>
<td>10:00</td>
<td>Eat, walk to Music</td>
</tr>
<tr>
<td>6:00</td>
<td>Homework</td>
<td>10:00</td>
<td>Homework</td>
</tr>
<tr>
<td>6:00</td>
<td>Walk, walk to lunch</td>
<td>10:00</td>
<td>Walk, walk to lunch</td>
</tr>
<tr>
<td>6:00</td>
<td>Math, walk to homework</td>
<td>10:00</td>
<td>Math, walk to homework</td>
</tr>
<tr>
<td>6:00</td>
<td>Social Studies, walk to Math</td>
<td>10:00</td>
<td>Social Studies, walk to Math</td>
</tr>
<tr>
<td>6:00</td>
<td>English, walk to Social Studies</td>
<td>10:00</td>
<td>English, walk to Social Studies</td>
</tr>
<tr>
<td>6:00</td>
<td>Get dressed, walk to school, talk with friends</td>
<td>10:00</td>
<td>Get dressed, walk to school, talk with friends</td>
</tr>
<tr>
<td>6:00</td>
<td>Sleep</td>
<td>5:00</td>
<td>Sleep</td>
</tr>
<tr>
<td>6:00</td>
<td>Poker</td>
<td>5:00</td>
<td>Poker</td>
</tr>
<tr>
<td>6:00</td>
<td>Homework</td>
<td>5:00</td>
<td>Homework</td>
</tr>
<tr>
<td>6:00</td>
<td>Eat dinner, talk</td>
<td>5:00</td>
<td>Eat dinner, talk</td>
</tr>
<tr>
<td>6:00</td>
<td>Walk home chores, talk</td>
<td>5:00</td>
<td>Walk home chores, talk</td>
</tr>
<tr>
<td>6:00</td>
<td>Practise</td>
<td>5:00</td>
<td>Practise</td>
</tr>
</tbody>
</table>

**Total Minutes:**

[Student's Name]

Date: [Date Completed]
Lesson 1 Narrative

Altering Objectives

I found that during the construction of my activities, my content objectives, language objectives, and performance indicators changed multiple times. The gist of them stayed the same, but the grouping varied widely, from individual work to small groups to class discussions. The language objectives also vacillated between speaking and writing. Usually this was because the lesson flowed better with different groupings, or because I included ideas that I hadn’t thought of while planning the objectives, such as students coming to the board to categorize activities. I don’t know if objectives are supposed to be a rigid guideline for how to plan lessons, but after altering them, I am pleased with my outcome.

Making Content Comprehensible

Making the chart comprehensible for level 1s proved quite challenging. For the sake of the data needed in lesson 2, all students needed the same number of hours and the same five energy levels, so I could not simplify it that way. (Anyway, I think simplifying it that way would have been the opposite of amplifying…) I decided to use picture supports as much as possible, scaffold instruction and discussion of activities, and pair students so that they could negotiate meaning.

Goals for Future Lessons

I would like to increase readability. I would also like to include more activities from the “99” book, and include more big “wh” questions.
Lesson 2
**Content Objectives:**
1. SWBAT Calculate averages of data sets in small groups.
2. SWBAT Graph their individual data alongside the class average and compare the two amounts.

**Language Objectives:**
1. In small groups, students will have specified roles in determining the average.
2. Students will record the data on a bar graph and write a written reflection comparing the two columns.

<table>
<thead>
<tr>
<th>Domain/Topic</th>
<th>Nearly Fluent Level 5</th>
<th>Expanding Level 4</th>
<th>Emerging Level 3</th>
<th>Early Production Level 2</th>
<th>Pre-Production Level 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speaking/In small groups, students will combine each member’s data to ascertain an average.</td>
<td>Students will take leadership in their group using full sentences</td>
<td>Students will participate in their group using full sentences or short phrases</td>
<td>Students will participate in their group using sentence starters provided</td>
<td>Students will participate in their group by listening and engaging in choral repetitions with the class</td>
<td></td>
</tr>
<tr>
<td>Writing/Graphing their data with class data and writing response.</td>
<td>Students will write a paragraph (3-5) sentences comparing the data</td>
<td>Students will write a short paragraph (2-3) sentences comparing the data</td>
<td>Students will write using the prompt found on p. 5</td>
<td>Students will fill in the sentence starters found on p. 5.</td>
<td>Students will fill in the Level 2 sentence starters with a word bank (p. 5).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>Situation</th>
<th>Expressions</th>
<th>Words</th>
<th>Grammar/ Discourse Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculate</td>
<td>Averages of class data</td>
<td>1. ____ plus ____ equals ____</td>
<td>Both: 100, 50, 157, 568, etc.</td>
<td>Numbers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. ____ divided by ____ equals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compare/contrast</td>
<td>Their amount of moderate activity compared with the class average</td>
<td>1. I had ____ moderate activity than the class</td>
<td>1. more, less, an equal amount</td>
<td>Comparatives</td>
</tr>
</tbody>
</table>
Lesson 2

Main Lesson: Energy Balance: Calorie Intake and Physical Activity
Grade: 7-8
Lesson Time: 1 hour 15 minutes

Preparation
The desks are arranged in groups of 4, with a sign for READER, WRITER, CALCULATOR, and REPORTER on each desk.
The following chart is written on the board:

<table>
<thead>
<tr>
<th></th>
<th>Requires a MINIMAL amount of energy</th>
<th>Requires a VERY SMALL amount of energy</th>
<th>Requires a SMALL amount of energy</th>
<th>Requires a MODERATE amount of energy</th>
<th>Requires a LARGE amount of energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How to find the average: Add all numbers and divide by the number of items
Example: 2+4+6=12 12÷3=4

Materials
Each student should have their completed Physical Activity Chart
*If a student does not have their chart, have them use another student's, so that the data is not fabricated
A blank bar graph for each student (modified charts on p.7-10)
A calculator for each group
Colored pencils

Initiation (5 mins):
1. Prediction: Teacher asks students to look at their charts and predict whether they will have more or less moderate activity than the rest of the class.

Written modifications to use during predicting:
Level 5: Students will write a short paragraph (2-3) sentences describing their prediction
Level 4: Students will independently construct a sentence using the sentence starter “I predict”

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Level 3: Students will write given the sentence starter prompt (found on p. 5)
Level 2: Students will write using the prompt “I predict that I will have _____ moderate activity than the rest of the class” (found on p. 5)
Level 1: Students will write using the Level 2 prompt with a word bank (found on p. 5)

Procedure:

2. Students determine averages in groups (20 mins): Teacher explains students’ roles:
   READER (level 3-5): will collect the charts of the group and read the total in each category (minimal, very small, small, moderate, large) to the writer.
   WRITER (level 2-5): makes 5 columns, as seen on the board and writes the group totals in each column
   CALCULATOR (any level, math proficient): calculates the average.
   *Teacher explains example on the board (under the chart) then requests numbers from students and averages them, thinking aloud.
   REPORTER (level 1-3): writes the group average in each column on the board.

3. Calculating the class average (5 mins): Once every group has reported, assign each group a column to average and their reporter writes the final class average in the AVERAGE row on the board.

4. Choral repetition: Teacher says the average for each column and students repeat.

5. Students graph their data with the class data (20 mins): All students are given the bar graph template on p. (levelled modifications on subsequent pages).
   a. Teacher places Overhead Copy (p. 7) on projector and asks students to copy it, or fill in the blanks on their levelled chart.
   b. The columns will have two bars: one will represent the student’s results and the other will represent the class average. Students can use colored pencils to differentiate the columns.
      *Leave space for three bars in the moderate column, as students will enter the recommended number of minutes during Lesson 3.
   c. I do/we do/you do Teacher models drawing one column based on the minutes from an example student chart. Model as many as required for students to understand.
   d. Students fill in their graphs. Teacher walks around the room to answer questions and check understanding.

6. Discussion Questions (15 mins): Teacher asks students what kinds of questions could be asked using the data from the graphs, such as “do students have higher levels of activity on weekends or on weekdays?” or “do students have less activity as they get older?” Write these questions on the board as examples.
   a. in groups, students discuss possible questions that could be posed from the data and what further data they would need (ie: does time of year or geographic location have an impact on activity levels?)
   b. teacher writes some question words on the board for level 2 and 3 students: what, how many, who, why

Oral modifications to use during discussion:
Level 5: Students will use complete sentences in formulating questions
Level 4: Students will use complete sentences or short phrases in formulating questions

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Level 3: Students will use the question words written on the board to formulate questions
Level 2: Students will work with the teacher, who asks either/or questions, some of which could be answered with the chart, and some of which could not (or need more information)
Level 1: Students will write on the discussion prompt (found on p. 6)

**Closure:**

**Exit ticket/homework (5-10 mins):** students will write to compare their amount of moderate activity with the class average.

**Written modifications to use during comparing:**
Level 5: Students will write a paragraph (3-5) sentences comparing the data
Level 4: Students will write a short paragraph (2-3) sentences comparing the data
Level 3: Students will write using the prompt (found on p. 5)
Level 2: Students will fill in the sentence starters (found on p. 5)
Level 1: Students will fill in the Level 2 sentence starters with a word bank (found on p. 5)
**Opener**

Level 3
I predict that  

Level 2
I predict that I will have ________ moderate activity 🚴 than the rest of the class.

Level 1
I predict that I will have ________ moderate activity 🚴 than the rest of the class.

more
dless

**Exit ticket/Homework**

Level 3
I had ________ moderate activity than ____________________________

My opinion on this is ____________________________________________

Level 2
I had ________ moderate activity than the rest of the class.

My opinion is ________________________________________________

OR

I feel ______________________________________________________

Level 1
I had ________ moderate activity than the rest of the class.

more
dless

I feel ______________________________________________________
surprised unhappy happy

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**Level 1 Discussion Prompt:**

Circle 3 questions we can ask using the data:

How many minutes of heavy activity did the class do?

Did the class do more SMALL amount of energy or VERY SMALL amount of energy?

What is energy?

Which energy level has the most minutes?

Optional: Write or draw a question about the data:
Key:

☐ = my results
☐ = class results
☐ = recommended amount

Physical Activity Graph

<table>
<thead>
<tr>
<th>Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>150</td>
</tr>
<tr>
<td>200</td>
</tr>
<tr>
<td>250</td>
</tr>
<tr>
<td>300</td>
</tr>
<tr>
<td>350</td>
</tr>
<tr>
<td>400</td>
</tr>
<tr>
<td>450</td>
</tr>
<tr>
<td>500</td>
</tr>
<tr>
<td>550</td>
</tr>
<tr>
<td>600</td>
</tr>
<tr>
<td>650</td>
</tr>
</tbody>
</table>

Amount of Energy Required

Generic Bar Graph Template

tkawas@mathwire.com
Key:
☐ = my results
☐ = class
☐ = recommended

Physical Activity

of Energy Required

Level 2
Physical Activity Graph

Key:
☐ = my results
□ = class results
□ = recommended

---

Minutes

0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1,000 1,050 1,100 1,150 1,200 1,250 1,300 1,350 1,400 1,450 1,500

Energy Required

---

minimal / very / small

moderate / large

Level 1
Narrative Lesson 2

Supplementary Materials

A large amount of differentiated supplementary materials are found for this lesson. Pre-production students would have a hard time making predictions or posing new questions about the data, so I formulated small worksheets for them. I try to have each language level work at their full capacity, making assignments neither too hard nor too easy for them.

Numbers

My hope in including numbers in the lesson is that it will empower level 1s and 2s who are proficient in math. Thus, I have assigned them to be calculators and reporters in their groups. (The reporters do not speak, they simply write the averages on the board) Ideally, they will feel integral to the class as they calculate and write their groups’ responses on the board.

Unfortunately, my lesson relies on students knowing the basics of pronouncing numbers in English. I realize that this is presumptuous, but at the moment, I’m unable to squeeze such a lesson into the content. If a teacher, in the middle of this lesson, realizes that students don’t know how to pronounce numbers, perhaps she could scaffold by working closely with the struggling students, or prepare a mini-lesson on numbers for the following day.

Another basic skill woven into this lesson is graphing. The teacher may have to do a more in-depth explanation individually or as a class if students do not know how to graph.

The “ph” grapheme

This lesson could be a valuable opportunity to alert students to the fact that “ph” creates an /f/ sound, as the graphs are titled “Physical Activity Graph”.
Lesson 3
### Content Objectives:
1. SWBAT assess the fitness levels of people portrayed in pictures through a value line activity.
2. SWBAT Predict kids’ fitness levels in the future and propose ways that kids can meet the recommended fitness levels through answering questions in a group.

### Language Objectives:
1. Students will orally explain why they chose their position on the value line.
2. In small groups, students will orally discuss ways to meet exercise recommendations and present them to the class.

<table>
<thead>
<tr>
<th>Domain/Topic</th>
<th>Nearly Fluent Level 5</th>
<th>Expanding Level 4</th>
<th>Emerging Level 3</th>
<th>Early Production Level 2</th>
<th>Pre-Production Level 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speaking/Justifying their assessment of a person’s fitness level</td>
<td>Students will respond with complete sentences</td>
<td>Students will respond with complete sentences or phrases.</td>
<td>Students will respond using the sentence prompt</td>
<td>Students will respond using the sentence prompt or single words</td>
<td>Students will participate in any choral responses</td>
</tr>
<tr>
<td>Speaking/Proposing solutions to society-wide problems with exercise, in group discussion, then in class presentation</td>
<td>Students will use complete sentences in their group discussion, then present their group’s proposal in their own words, using complete sentences, with the worksheet only as a reference</td>
<td>Students will use complete sentences or phrases in their group discussion, then present their group’s proposal in complete sentences, reading from the worksheet as necessary.</td>
<td>Students will use phrases or sentence prompts in their group discussion, then present their group’s proposal in mostly complete sentences, able to read from the worksheet.</td>
<td>Students will use sentence prompts, phrases, or single word in their group discussion, then present their group’s proposal in short phrases, able to read from the worksheet.</td>
<td>Students will use single words or NL in group discussion, then present their group’s proposal by chorally repeating their answers after the teacher.</td>
</tr>
<tr>
<td>Function</td>
<td>Situation</td>
<td>Expressions</td>
<td>Words</td>
<td>Grammar/ Discourse Structures</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------------------</td>
<td>--------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>--------------------------------</td>
<td></td>
</tr>
<tr>
<td>Describing and justifying</td>
<td>Person’s fitness level based on photo</td>
<td>I think this person is 1. _____ because 2. _____</td>
<td>1. fit, unfit, somewhat fit 2. he/she is running, he/she is not exercising, he/she is eating unhealthy food</td>
<td>1. Adjectives 2. present continuous verbs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suggesting</td>
<td>Ways kids can meet fitness standards</td>
<td>1. We propose that students _____</td>
<td>1. join a sport, walk to school, eat healthier foods, get more moderate exercise</td>
<td>1. Imperative verbs</td>
<td></td>
</tr>
</tbody>
</table>
Lesson 3

Main Lesson: Energy Balance: Calorie Intake and Physical Activity
Grade: 7-8
Lesson Time: 1 hour 15 minutes

Preparation
The desks are arranged in groups of three, with a sign for READER, WRITER, and REPORTER on each desk. Students should be grouped by language proficiency.

Materials
A copy of “Kids Worldwide” (modified by level, beginning on p. 7) for each group
Copies of images (p. 5-6) for the overhead

Initiation (5 mins):
Word Square for “fit”: Teacher draws a 6-square chart on the board (below) and writes the word “fit” in box 1. Students should copy the chart. Meanwhile, teacher asks students what they know about the word “fit”. If they get the definition “in good physical condition, in good health”, then write it.

As a class, brainstorm ideas to fill the rest of the squares and ask students to fill them in on their papers.

*The word “fitness” will appear in the articles for class, so it could be a good time to alert them of this word as well.

*Students may also know “fit” in the sense of items fitting into other items. It can be explained that these are homonyms.

<table>
<thead>
<tr>
<th>Word: Fit</th>
<th>Picture:</th>
</tr>
</thead>
<tbody>
<tr>
<td>In your own words:</td>
<td>What do you think of?</td>
</tr>
<tr>
<td>Definition: in good physical condition, in good health</td>
<td>What it is not:</td>
</tr>
</tbody>
</table>

Procedure:
1. What does fit look like? (10 mins) It is important to consider students’ insecurities during this unit and important for them to know that as long as you exercise enough and eat right, you are healthy, even if your body is larger. Explain this to students.
2. Value line: Establish a value line in the room, with one side being “very fit” and one side being “very unfit”. One by one, show students the images (p.5-6) and ask them to stand at the level of fitness for each image. (if an image has two people it in, do separate value lines for each person represented) Randomly ask students why they chose their position. (Although there is ambiguity in each picture, the idea is that the exercising people are fit, no matter what size they are)

*Write sentence prompt on board: “I think this person is _______ because…”

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Oral modifications for value line questions:
Level 5: Students will respond with complete sentences
Level 4: Students will respond with complete sentences or phrases.
Level 3: Students will respond using the sentence prompt
Level 2: Students will respond using the sentence prompt or single words
Level 1: Students will participate in any choral responses

3. Groups read the article, write their ideas, and present their answers (55 mins):
   In groups, the READER will read the article out loud. The other students listen.
   Afterwards, the WRITER will record the group’s ideas on the worksheet (following each article). The SPEAKER will then share the groups’ conclusions with the class.

Textual modifications to use during reading:
Level 5: Students will read article found on p. 7
Level 4: Students will read article found on p. 11
Level 3: Students will read article found on p. 15
Level 2: Students will read article found on p. 19
Level 1: Teacher will support students in reading article on p. 23. If necessary, she will read aloud and have them repeat words or phrases.

Written modifications to use during writing:
Each levelled article has discussion questions at the end

Oral modifications to use during group discussion and presentations:
Level 5: Students will use complete sentences in their group discussion, then present their group’s proposal in their own words, using complete sentences, with the worksheet only as a reference.
Level 4: Students will use complete sentences or phrases in their group discussion, then present their group’s proposal in complete sentences, reading from the worksheet as necessary.
Level 3: Students will use phrases or sentence prompts in their group discussion, then present their group’s proposal in mostly complete sentences, able to read from the worksheet.
Level 2: Students will use sentence prompts, phrases, or single word in their group discussion, then present their group’s proposal in short phrases, able to read from the worksheet.
Level 1: Students will use single words or NL in group discussion, then present their group’s proposal by chorally repeating their answers after the teacher.

*Assessment: The group reading and presentation activity can be an assessment for these lessons (graded or ungraded) to gauge what students have learned and how they are able to critically think and speak about exercise, energy expenditure, and health.

Closure (5 mins):
Put the filled-in sample Physical Activity Chart (Lesson 1 p. 10) on the overhead. Ask students to position themselves on the value line as to whether they think this person is physically fit or not. Randomly ask student why they chose their position.

Caldwell
Fit or Unfit: Value Line

Caldwell
Kids worldwide are less fit than their parents, a study says

DALLAS — Today's kids can't keep up with their parents. Data from millions of children around the world shows they don't run as fast or as far as their parents did when they were young.

On average, it takes children 90 seconds longer to run a mile than their counterparts did 30 years ago. Heart-related fitness has declined 5 percent per decade since 1975 for children ages 9 to 17.

The research was presented at the American Heart Association's conference last week. The association says it's the first report to show that children's fitness has declined worldwide over the last three decades.

"It makes sense. We have kids that are less active than before," said Dr. Stephen Daniels, a University of Colorado pediatrician and spokesman for the heart association.

"Sedentary Children"

Health experts recommend that children 6 and older get 60 minutes of moderate activity a day. Only one-third of American kids do now.

"Kids aren't getting enough opportunities to build up that activity over the course of the day," Daniels said. "Many schools, for economic reasons, don't have any physical education at all. Some rely on recess to provide exercise."

Sam Kass, head of first lady Michelle Obama's Let's Move program, stressed the role of schools in a speech to the conference on Monday.

"We are currently facing the most sedentary generation of children in our history," Kass said.

The new study was led by Grant Tomkinson, an exercise physiologist at the University of South Australia. Researchers analyzed 50 studies on running fitness — a key measure of cardiovascular health and endurance — involving 25 million children ages 9 to 17 in 28 countries from 1964 to 2010.

The studies measured how far children could run in 5 to 15 minutes and how quickly they ran a certain distance, ranging from half a mile to two miles. Today's kids are about 15 percent less fit than their parents were, researchers concluded.

"The changes are very similar for boys and girls and also for various ages," but differed by geographic region, Tomkinson said.

By Associated Press, adapted by Newsela staff, further adapted by Eliza Caldwell
Not Enough Exercise

The decline in fitness seems to be leveling off in Europe, Australia and New Zealand, and perhaps in the last few years in North America. However, it continues to fall in China, and Japan never had much falloff — fitness has remained fairly consistent there. About 20 million of the 25 million children in the studies were from Asia.

In China, annual fitness test data show the country's students have become slower and fatter over the past several decades.

Experts and educators blame declining fitness levels on China's competitive college admissions which place too much importance on academic testing scores, as well the spread of indoor entertainment options such gaming and web surfing.

China's Education Ministry data show that in 2010 male college students ran 1,000 meters 14 to 15 seconds slower on average than male students who ran a decade earlier. Female students slowed by about 12 seconds in running 800 meters.

Motoaki Nito of Japan's Ministry of Education, Culture, Sports, Science and Technology said there had been a decline in physical fitness among youth since the 1980s.

To turn that around, the government has urged cities, towns and schools to promote youth fitness. Nito said that this had resulted in a gradual increase of physical strength, which while not equal to levels seen in the 1980s, had reversed the trend.

Tomkinson and Daniels said obesity likely plays a role, since it makes it harder to run or do any aerobic exercise. Too much time watching television and playing video games and unsafe neighborhoods with not enough options for outdoor play also may play a role, they said.

World Health Organization numbers suggest that 80 percent of young people globally may not be getting enough exercise.

By Associated Press, adapted by Newsela staff, further adapted by Eliza Caldwell
**BIG Questions**

With your group, brainstorm ideas about each question and afterwards formulate a response to be read to the group.

1. Do you think children 30 years in the future will be less fit than children today? Why?
   Brainstorm space:

   Final answer:

   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

2. What do you think schools can do to help students get enough exercise?
   Brainstorm space:

   By Associated Press, adapted by Newsela staff, further adapted by Eliza Caldwell
3. How do you think children can meet the recommended fitness amounts? 
Brainstorm space:

By Associated Press, adapted by Newsela staff, further adapted by Eliza Caldwell
Kids worldwide are less fit than their parents, a study says

DALLAS — Today's kids can't keep up\(^1\) with their parents. Data from millions of children around the world shows they don't run as fast or as far as their parents did when they were young.

On average, it takes children 90 seconds longer to run a mile than their counterparts\(^2\) did 30 years ago. Heart-related fitness has declined 5 percent per decade since 1975 for children ages 9 to 17.

The research was presented at the American Heart Association's conference last week. The association says it's the first report to show that children's fitness has declined worldwide over the last three decades.

"It makes sense. We have kids that are less active than before," said Dr. Stephen Daniels, a University of Colorado pediatrician.

"Sedentary\(^3\) Children"

Health experts recommend that children 6 and older get 60 minutes of moderate activity a day. Only one-third of American kids do now.

"Kids aren't getting enough opportunities to participate in activity over the course of the day," Daniels said. "Many schools, for economic reasons, don't have any physical education at all. Some rely on recess" to provide exercise.

Sam Kass, head of first lady Michelle Obama's Let's Move program, stressed the role of schools in a speech to the conference on Monday.

"We are currently facing\(^4\) the most sedentary generation of children in our history," Kass said.

Today's kids are about 15 percent less fit than their parents were, researchers have concluded.

"The changes are very similar for boys and girls and also for various ages," but varied by geographic region, Tomkinson said.

---

\(^1\) Can't keep up: can't run as fast  
\(^2\) Counterparts: children the same age  
\(^3\) Sedentary: Sitting a lot  
\(^4\) Currently facing: now seeing  

By Associated Press, adapted by Newsela staff, further adapted by Eliza Caldwell
Not Enough Exercise

In China, annual fitness test data show the country's students have become slower and fatter over the past several decades.

Experts and educators blame declining⁵ fitness levels on China's competitive college admissions which place too much importance on academic testing scores, as well the spread of indoor entertainment options such gaming and web surfing.

China's Education Ministry data show that in 2010 male college students ran 1,000 meters 14 to 15 seconds slower on average than male students who ran a decade earlier. Female students slowed by about 12 seconds in running 800 meters.

To change this, the government has urged cities, towns and schools to promote youth fitness. Nito said that this had resulted in a gradual increase of physical strength.

Tomkinson and Daniels said obesity likely plays a role⁶, since it makes it harder to run or do any aerobic exercise. Too much time watching television and playing video games and unsafe neighborhoods with not enough options for outdoor play also may play a role, they said.

World Health Organization numbers suggest that 80 percent of young people globally may not be getting enough exercise.

⁵ Declining: decreasing
⁶ Play a role: to cause

By Associated Press, adapted by Newsela staff, further adapted by Eliza Caldwell
BIG Questions

With your group, brainstorm ideas about each question and afterwards write a response to read to the group.

1. Do you think children 30 years in the future will be less fit than children today? Why?
   Brainstorm space:

   Final answer:
   
   
   
   
   
   
   

2. What do you think schools can do to help students get enough exercise?
   Brainstorm space:

By Associated Press, adapted by Newsela staff, further adapted by Eliza Caldwell
Final answer:

3. How do you think children can meet the recommended fitness amounts? 
Brainstorm space:

Final answer:
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DALLAS — Today's kids can't keep up\(^1\) with their parents. Data from millions of children around the world shows they don't run as fast or as far as their parents did when they were young.

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"We are seeing the most sedentary generation of children in history," Kass said.

Today's kids are about 15 percent less fit than their parents were, researchers concluded.

"The changes are very similar for boys and girls and also for various ages," but varied by geographic region, Tomkinson said.

Not Enough Exercise

In China, annual fitness test data show the country's students have become slower and fatter over the past several decades.

Experts and educators blame declining\(^4\) fitness levels on China's competitive college admissions. Test scores are too important. Also, kids play too many video games and spent too much time on the internet.

To change this, the government has urged cities, towns and schools to promote youth fitness. This results in a gradual increase of physical strength.

\(^1\) Can't keep up: can't run as fast
\(^2\) Counterparts: children the same age
\(^3\) Sedentary: Sitting a lot
\(^4\) Declining: decreasing

By Associated Press, adapted by Newsela staff, further adapted by Eliza Caldwell
Dr. Daniels says obesity plays a role⁵, since it makes it harder to run or do any aerobic exercise. Too much time watching television and playing video games and unsafe neighborhoods with not enough options for outdoor play also may play a role, they said.

World Health Organization suggests that 80 percent of young people globally may not be getting enough exercise.

---

⁵ Play a role: to cause

By Associated Press, adapted by Newsela staff, further adapted by Eliza Caldwell
BIG Questions

With your group, brainstorm ideas about each question and write a response to read to the group.

1. Do you think children 30 years in the future will be less fit than children today? Why?
   Sample sentences: We believe that students will be more fit because technology will make exercising easier.
   Thirty years in the future, children will be less fit because they ride cars everywhere.
   Brainstorm space:

Final answer:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

2. What do you think schools can do to help students get enough exercise?
   Sample sentences: By providing after-school exercise classes, schools can help students get exercise.
   Schools can help students get exercise by making gym class more fun.

   Brainstorm space:

By Associated Press, adapted by Newsela staff, further adapted by Eliza Caldwell
Final answer:

3. How do you think children can meet the recommended fitness amounts?
   Sample sentences: One way students can get the recommended amount of exercise is by walking to school.
   We propose that students join a sport to get the recommended amount of exercise.
   Brainstorm space:

Final answer:

By Associated Press, adapted by Newsela staff, further adapted by Eliza Caldwell
Kids are less fit than their parents

DALLAS — Today's kids can't run as fast as their parents. Why? Because kids aren't getting enough exercise.

For 46 years, children around the world have been timed on how fast they can run. They were also measured on how far they could go.

The results were not pretty: kids today are slower and weaker than kids 30 years ago.

"Kids Are Less Active"

For boys and girls of all ages, fitness levels have decreased.

"It makes sense. We have kids that are less active than before," said Dr. Stephen Daniels. He is a Colorado doctor who treats children.

Health experts recommend that children 6 and older get 60 minutes of moderate activity a day. Only one-third of American kids do now.

There are many reasons why kids today are less fit. Tomkinson and Daniels said that weight might be the problem. Many children in the United States are at an unhealthy weight. Being very overweight makes it harder to run or do any heart-pumping exercise.

Television and video games may be a problem too. Many kids are spending time in front of screens instead of playing, they said. Also, some kids live in unsafe neighborhoods. They cannot go outdoors to play, they added.

Heavier And Slower

There's no more gym class at many schools, Daniels said. For some kids, recess is the only chance they get to exercise during school, he added.

Sam Kass is a chef at the White House. He also helps first lady Michelle Obama with her Let's Move program. The first lady started the program to help kids eat more healthy food and exercise.

Kass said schools have to get involved. Today's children are the least active in U.S. history, he said.

American kids are not alone. Young Chinese students have become slower and heavier.

By Associated Press, adapted by Newsela staff, further adapted by Eliza Caldwell
Experts blame China's school system. Getting into college is very hard. They say Chinese students have to spend too much time studying for tests. They also blame the Internet and video games. Such activities decrease fitness.

By Associated Press, adapted by Newsela staff, further adapted by Eliza Caldwell
BIG Questions

With your group, write ideas about each question and write a response to read to the group.

1. Thirty years in the future, will children be less fit or more fit than children today? List your reasons.
   Sample sentences: We believe that students will be more fit because technology will make exercising easier.
   Thirty years in the future, children will be less fit because they ride cars everywhere.

   Ideas:

   Final answer:

   ____________________________
   ____________________________
   ____________________________
   ____________________________
   ____________________________
   ____________________________

2. List ways schools can help students get exercise.
   Sample sentences: By providing after-school exercise classes, schools can help students get exercise.
   Schools can help students get exercise by making gym class more fun.

   Brainstorm space:

By Associated Press, adapted by Newsela staff, further adapted by Eliza Caldwell
3. List ways that children can get the recommended amount of exercise.
   Sample sentences: One way students can get the recommended amount of exercise is by walking to school.
   We propose that students join a sport to get the recommended amount of exercise.
   Brainstorm space:

   Final answer:

   By Associated Press, adapted by Newsela staff, further adapted by Eliza Caldwell
Kids today are not fit

DALLAS — Kids today can't run as fast as their parents. Why? Because kids aren't getting enough exercise.

For 46 years, children around the world have been timed on how fast they can run. They were also measured on how far they could go.

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Heavier And Slower

There are no more gym class at many schools, Daniels said. For some kids, recess is the only chance they get to exercise during school, he added.

Kids all over the world have this problem. Kids in China do not exercise enough.

By Associated Press, adapted by Newsela staff, further adapted by Eliza Caldwell
BIG Questions
Answer the questions with your group. You will share with the class.

1. 30 years in the future

Today:
- Kids are not fit

Future: (circle one)
- Kids are more fit
- Kids are less fit

If more fit, circle why:
- Health education
- More exercise
- Technology helps
- Schools help
- Parents help
- Healthier food
- More outdoor activities
- Other: _____________

If less fit, circle why:
- No health education
- Less exercise
- Computer games
- Schools don't help
- Parents don't help
- Unhealthy food
- No outdoor activities
- Other: _____________

2. Circle 3 things that schools can do to help students get exercise:

- Health education
- More exercise
- Healthier food
- More outdoor activities
- More gym
- More recess
- Contests/games
- Ask parents to help
- Other: ________________
3. Circle 3 things that *kids can do* to get exercise:

- More outdoor activities
- Ask parents to help
- Ask friends to help
- Less computer games
- Play sports
- Walk to school
- Other: ________________________________
  ________________________________

By Associated Press, adapted by Newsela staff, further adapted by Eliza Caldwell
Narrative Lesson 3

Value Line
I decided to do a value line to get students moving, thinking, and expressing themselves. It’s a great way for Level 1s to assert their opinion without having to speak.

Body Image
The value line activity links in with body image and I attempted to treat the issue sensitively. Students who are overweight or have other body image issues may feel persecuted in lessons on health, so I wanted to include the idea that as long as you exercise and eat healthily, your body is healthy. I hope I have treated the idea sensitively and comprehensibly.

Where do we go from here?
We have addressed the idea of getting enough exercise, now what about the other end of the equation: healthy eating? Ideally, a unit on healthy eating would follow this lesson. Students could keep food diaries similar to their activity diaries. A cultural aspect could be incorporated; students could share the foods they eat in their homes.

One facet of healthy eating and exercise that affects low-income children is accessibility. Oftentimes, students live in communities with little fresh produce available. If it is available, sometimes their families cannot afford it or do not know how to cook it. In my original conception of this lesson, there was a final lesson addressing these issues, but alas, I have run out of time and space. Were I to execute this lesson in the real world, I would develop such a lesson to help students connect economic issues with healthy habits.
Checklists
TSL 518: Sheltered ELL Strategies Checklist

Write the page numbers and any other identifying features to identify those parts of your lessons that employ the following strategies.

<table>
<thead>
<tr>
<th>SHELTERED STRATEGIES</th>
<th>Lesson 1</th>
<th>Lesson 2</th>
<th>Lesson 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Contextualize Lesson</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.A. Build and Activate Background Knowledge</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>I.B. Develop Vocabulary</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>I.C. Use extensive Visuals, Realia, Manipulatives, &amp; Gestures</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>I.D. Model (Instructions, Processes)</td>
<td>3, 4, 5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I.E. Create Opportunities To Negotiate Meaning</td>
<td>4</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>II. Make Text Comprehensible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II.A. Intentional Use of Graphic Organizers</td>
<td>5, 7, 8</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>II.B. Modify Written Text</td>
<td>8</td>
<td>9-11</td>
<td>7-25</td>
</tr>
<tr>
<td>II.C. Amplify Number of Activities per Text</td>
<td>3, 4, 5</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>III. Make Talk Comprehensible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III.A. Pace Teacher’s Speech</td>
<td>3, 4, 5</td>
<td>2, 3</td>
<td>3</td>
</tr>
<tr>
<td>III.B. Use of Listening Guides</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III.C. Use of Word Walls</td>
<td>4-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III.D. Frame Main Ideas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III.E. Check for Understanding</td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>IV. Change Traditional Classroom Talk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV.A. Use Teacher Question and Response Strategies</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV.B. Practice Instructional Conversations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V. Engage at Appropriate Language Proficiency Levels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V.A. Vary Question Techniques based on Student’s Language</td>
<td>4, 5, 6</td>
<td>2-6, 8-11</td>
<td>3, 4, 7-25</td>
</tr>
<tr>
<td>Proficiency level-- in conversations, activities, and assessments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VI. Give Students Voice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VI.A. Challenge students to produce extended academic talk</td>
<td>5</td>
<td>3-4</td>
<td>4</td>
</tr>
<tr>
<td>VI.B. Model Language for Oral and Written Production</td>
<td>4, 5</td>
<td></td>
<td>3, 4, 7-25</td>
</tr>
<tr>
<td>VI.C. Use Group/Pr. Work to Elicit Student Talk; Students as Researchers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VI.D. Respond to Student’s Voice – Writing and Error Correction</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Unit: Energy Balance
Grammar and Functions Checklist

<table>
<thead>
<tr>
<th>Grammar</th>
<th>Lesson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominalization of verbs</td>
<td>1</td>
</tr>
<tr>
<td>Comparative adjectives</td>
<td>1, 2</td>
</tr>
<tr>
<td>Expressions of time</td>
<td>1</td>
</tr>
<tr>
<td>Simple past</td>
<td>1</td>
</tr>
<tr>
<td>Numbers</td>
<td>1, 2</td>
</tr>
<tr>
<td>Adjectives</td>
<td>3</td>
</tr>
<tr>
<td>Present continuous verbs</td>
<td>3</td>
</tr>
<tr>
<td>Imperative verbs</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Functions</th>
<th>Lesson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Give Examples</td>
<td>1, 3</td>
</tr>
<tr>
<td>Evaluate</td>
<td>1</td>
</tr>
<tr>
<td>Sequence</td>
<td>1</td>
</tr>
<tr>
<td>Calculate</td>
<td>2</td>
</tr>
<tr>
<td>Compare/contrast</td>
<td>2</td>
</tr>
<tr>
<td>Describe/justify</td>
<td>3</td>
</tr>
</tbody>
</table>
Original Lessons
Overview
This lesson consists of two activities and takes two to three days to complete. In the first activity, students develop an understanding of energy as it relates to body function. Students collect data about their own physical activities for a school day and a weekend day and then estimate the energy used in these activities. In the second activity, students enter energy expenditure data from their diaries into a Web or a classroom database. The Web database contains entries from other students in their class as well as from students across the country. Using this information, students can test their own hypotheses about energy use in middle school students. Alternatively, students enter their data into a classroom database, which they then use to test their hypotheses about their classmates' energy use. More questions can be asked and answered with the Web database than with the classroom database.

Major Concepts
Humans require energy to function. The total energy used by an individual depends on the type and intensity of that person's activity and the energy required for basic life processes. The total energy used by an individual varies from day to day and from one individual to another.

Objectives
After completing this lesson, students will
• be able to describe ways humans use energy,
• demonstrate increased understanding of the scientific process,
• demonstrate increased knowledge about how they spend their time,
• be able to evaluate their personal activity level, and
• explain that activity levels vary from day to day and among individuals.
Teacher Background
See the following sections in Information about Energy Balance:
1 Introduction
2 Preconceptions about energy balance
3.1 The energy balance equation

In Advance
Web-Based Activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Web Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Photocopies

<table>
<thead>
<tr>
<th>Activity 1</th>
<th>Activity 2</th>
</tr>
</thead>
</table>
| • Master 1.1, *Physical Activity Diary: School Day*, 1 copy per student  
• Master 1.2, *Physical Activity Diary: Weekend Day*, 1 copy per student  
• Master 1.3, *Some Typical Activities, by Intensity Level*, 1 transparency  
• Master 1.4, *Sample Physical Activity Diary for a School Day*, 1 transparency  
| • Master 1.5, *Total Calories Used Per Day at Various Intensity Levels*, 1 copy per student and 1 transparency for class use |

Materials

<table>
<thead>
<tr>
<th>Activity 1</th>
<th>Activity 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>none needed (except photocopies)</td>
<td>none needed (except photocopies)</td>
</tr>
</tbody>
</table>

Preparation
Activity 1
Ask students to have their completed physical activity diaries available.

Activity 2
Ask students to bring a calculator to class. If you are using the Web version of this activity, you must establish a unique class code for each class that will enter data into the Web database. To do this, go to the URL [http://science.education.nih.gov/supplements/energy/student](http://science.education.nih.gov/supplements/energy/student). Click on “Teacher Database Administration.” When prompted, enter the username “energyadmin” and the password “admin.” Click “Okay” to enter this site and register your classes. Write down the password (or passwords).
that appears on the screen. The password(s) will also be sent to your e-mail address. Verify that the computer lab is reserved for your classes to do Activity 2 or that classroom computers are ready to use.

If you are using the print version of this activity, no other preparation is needed.

Activity 1: What Is Energy?

Teacher note: In this activity, students record their physical activities for two 24-hour periods, one school day and one weekend day. We suggest that you begin this activity on a Friday. During class, provide each student with a copy of Master 1.1, Physical Activity Diary: School Day, and begin helping students fill out the form. Students complete the form on their own. Also on that Friday, provide each student with a copy of Master 1.2, Physical Activity Diary: Weekend Day, and ask students to keep a physical activity record for either Saturday or Sunday. This allows students to compare physical activity levels on a school day with those on a weekend day in Activity 2.

1. Ask students, “What is energy?”

Accept all responses and post them on the board. Energy allows us, or provides us with the ability, to do work. Energy may be stored for later use, or it may be used immediately to do something, such as provide light, heat, or motion. Students may view energy simply as something that lets you do things, such as run, walk, or just stay alive.

Teacher note: Asking this question requires students to call on their prior knowledge and to engage their thinking. At this point, do not critique student responses. Appropriate teacher comments are short and positive, such as “good” and “what else?” Other appropriate teacher responses include, “Why do you believe that?” or “How do you know that?” Questions such as these allow the teacher to assess current student knowledge about the subject and adjust lessons accordingly. They also provide a springboard to “Let’s find out” or “Let’s investigate.” In general, it is time to move forward when the teacher sees that thinking has been engaged.

2. Continue by asking, “Do living things require energy?” Follow this with, “How do living things get their energy?”

It is important to establish that all living things do need energy. This could be a time to reinforce the idea that the continuous use of energy is one of the features that helps distinguish living from
nonliving things. This is also a good place to define food as the source of materials and energy needed to support life. Food as a source of energy will be explored in Lessons 2 and 3.

3. After establishing the idea that living things require and use energy, ask students to name things they do that use energy.

List student responses on the board. List enough activities that a wide range of types and intensities is included. Students may respond with activities such as running, walking, riding bicycles, or playing sports. Ask them to consider reading, thinking, sleeping, and growing. Do these activities require energy? Lead students to the idea that humans, like all living things, require energy continuously.

Teacher note: The base level of energy required to maintain basic body function is called the basal metabolic rate, or BMR. Typical teenagers use 60 to 70 percent of their energy to maintain normal body function, or basal metabolism. You may need to define metabolism for students: the sum of all chemical reactions occurring in the body.

4. Referring to the list of activities on the board, ask students if these activities all use the same amount of energy.

Students should recognize that the energy required to perform different activities varies.

5. Ask students what determines how much energy they use in a physical activity.

Energy use is determined by both the intensity and the duration of the activity. Students may not know that energy use is also determined by body size.


Students will record their physical activities for 24 hours on a school day using their copy of Master 1.1. They will repeat this for a weekend day using Master 1.2.

7. Show students the transparency of Master 1.3, Some Typical Activities, by Intensity Level.

Teacher note: The values listed in the table on Master 1.3 represent average values for middle-school-aged individuals for a range of
activities within each category. The values include the calories used for BMR.

8. Refer to the list of activities on the board from Step 3. Ask students to consider the activity category (resting/sleeping, very light, light, moderate, or heavy) into which their typical activities fall.

Students should recognize that activities can be separated and organized based on their intensity. Resting activities use the least energy over a given time, while high-level activities require the most energy over that same time period.

Tip from the field test: Emphasize that the calories listed for the activities in Master 1.3 are calories per hour. This will help students understand why they need to divide the number of minutes they spent at each activity level by 60 on Master 1.5, Total Calories Used Per Day at Various Intensity Levels, in Activity 2, Steps 2 and 3.

9. Show students the transparency of Master 1.4, Sample Physical Activity Diary for a School Day. Explain that each line represents a full one-hour period (60 minutes).

This sample demonstrates that students are to use abbreviated descriptions of their activities in each 60-minute period and estimates of the number of minutes spent in activities at the various intensity levels.

10. Point out that the first time period on the diaries is from 5:00 a.m. to 6:00 a.m. that morning. The last period they will enter is 4:00 a.m. to 5:00 a.m. the next morning.

11. Tell students that they will begin their own physical activity diary for today in class. They first will consider the time from 5:00 a.m. to 6:00 a.m. that morning. Ask students to describe the activity or activities in the column labeled Activity and then enter the minutes spent in activities at each intensity level.

Use the transparency of Master 1.4 to point out that the individual in this example was sleeping during that one-hour period. Students, however, should enter their own activities during that time period. Tell students to estimate the time spent at each type of activity to the nearest five minutes.

Tip from the field test: Emphasize that the total minutes on each line should add to 60. Students are likely to participate in activities at more than one level during most one-hour periods. Tell students that they need to write only one or a few words to remind themselves of activities in which they participated in each time
slot. Point to examples on the transparency. For example, within a single hour, students may sit and listen in class, stand up and complete a lab exercise, walk to their lockers and to their next class, and stand in the hall and talk with friends. These students may record "science/walk & talk" in the Activity blank on the diary, and indicate 30 minutes of sitting activity for the time they sat and listened in science class and 30 minutes of light (walking) activity for the time they worked on the lab exercise, walked through the hallways, and stood and talked with friends. This gives a total of 60 minutes.

12. Ask students to enter their activities from 6:00 a.m. to 7:00 a.m. Students should continue until they reach the present time.

Assist students as they estimate the intensity levels of their activities and the amount of time they spent doing each activity. Be prepared to hold brief class discussions about activities that are difficult to categorize. Strive to develop a class consensus on how to categorize these activities. For example, a two-hour basketball practice may be composed of 30 minutes of sitting and listening and 90 minutes of running drills and playing the game. Students should enter both types of activity on their sheets (30 minutes of sitting and 30 minutes of heavy activity for the first hour and 60 minutes of heavy activity for the second hour).

13. Ask students to continue to fill in their diary throughout the day. Their final entry should be for the period from 4:00 a.m. to 5:00 a.m. the next morning.

Emphasize that the total 6 minutes for the 24-hour period must add to 1,440 (24 hours x 60 minutes/hour), as indicated in the diary.

14. Ask students to consider activities they are likely to engage in over the weekend that are different from their school-day activities. Resolve issues of how to categorize activities, as described above.

Doing this now will save time later when students enter their results in the database. You may also want to explain to students that they will enter information from their physical activity diary into a database on Monday. Emphasize that they will need a complete (24-hour) diary for both a school day and a weekend day.

Teacher note: The activity diaries contain rough profiles for each student's activity over two days. Nutrition specialists and physicians may combine more detailed activity diaries with food diaries to help diagnose possible relationships between activity and food intake for individuals outside normal weight guidelines. The diaries prepared for this activity
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Heavy/Moderate/Light/Sitting/Standing/Resting/Hungry (Total Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00 am</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7:00 am</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8:00 am</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9:00 am</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10:00 am</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11:00 am</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1:00 pm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2:00 pm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3:00 pm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4:00 pm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5:00 pm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6:00 pm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Minutes:**

- 60 minutes

Note: The number of minutes you spend on each type of activity (such as sleep, sitting, activities or light/moderate running activities).

**Keep track of your physical activities for a 24-hour period during the school week. Within each one-hour time slot, list the activities you participated in during that time.**

Date: __________________________

Name: __________________________

**Physical Activity Diary: School Day**
### Sample Physical Activity Diary for a School Day

<table>
<thead>
<tr>
<th>Time (local)</th>
<th>Activity</th>
<th>Time (24-hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00 a.m.</td>
<td>Sleep</td>
<td>6:00</td>
</tr>
<tr>
<td>7:00 a.m.</td>
<td>Breakfast</td>
<td>7:00</td>
</tr>
<tr>
<td>7:30 a.m.</td>
<td>Get dressed, walk to school, talk with friends</td>
<td>7:30</td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>English, walk to school</td>
<td>8:00</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>Social Studies, walk to Math</td>
<td>8:30</td>
</tr>
<tr>
<td>9:00 a.m.</td>
<td>Math, work to Humanities Lunch</td>
<td>9:00</td>
</tr>
<tr>
<td>10:00 a.m.</td>
<td>Science, work to Humanities Lunch</td>
<td>10:00</td>
</tr>
<tr>
<td>Noon</td>
<td>Noon</td>
<td>Noon</td>
</tr>
<tr>
<td>12:00 p.m.</td>
<td>Lunch</td>
<td>12:00</td>
</tr>
<tr>
<td>1:00 p.m.</td>
<td>Math, work to Humanities Lunch</td>
<td>1:00</td>
</tr>
<tr>
<td>2:00 p.m.</td>
<td>Science, work to Math</td>
<td>2:00</td>
</tr>
<tr>
<td>2:30 p.m.</td>
<td>Science, work to Humanities Lunch</td>
<td>2:30</td>
</tr>
<tr>
<td>3:00 p.m.</td>
<td>Science, work to Math</td>
<td>3:00</td>
</tr>
<tr>
<td>3:30 p.m.</td>
<td>Science, work to Humanities Lunch</td>
<td>3:30</td>
</tr>
<tr>
<td>4:00 p.m.</td>
<td>Science, work to Math</td>
<td>4:00</td>
</tr>
<tr>
<td>5:00 p.m.</td>
<td>Homework, work to Math, lunch</td>
<td>5:00</td>
</tr>
<tr>
<td>6:00 p.m.</td>
<td>Walk Home, do chores, talk</td>
<td>6:00</td>
</tr>
<tr>
<td>6:30 p.m.</td>
<td>Walk, Home, do chores, talk</td>
<td>6:30</td>
</tr>
<tr>
<td>7:00 p.m.</td>
<td>Homework</td>
<td>7:00</td>
</tr>
<tr>
<td>8:00 p.m.</td>
<td>TV phone, go to bed</td>
<td>8:00</td>
</tr>
<tr>
<td>8:30 p.m.</td>
<td>TV phone</td>
<td>8:30</td>
</tr>
<tr>
<td>9:00 p.m.</td>
<td>TV phone</td>
<td>9:00</td>
</tr>
<tr>
<td>9:30 p.m.</td>
<td>Watch TV</td>
<td>9:30</td>
</tr>
<tr>
<td>10:00 p.m.</td>
<td>Read a book</td>
<td>10:00</td>
</tr>
<tr>
<td>11:00 p.m.</td>
<td>Read a book</td>
<td>11:00</td>
</tr>
<tr>
<td>12:00 a.m.</td>
<td>Sleep</td>
<td>12:00</td>
</tr>
</tbody>
</table>

**Total Minutes Spent on Activity**: 600

*Note: This is a sample activity diary for a school day. Adjust the activities and times according to your schedule.*
are not diagnostic. They are simple estimates that do not offer sufficiently detailed information to make recommendations about changes in diet or activity. They are intended only to provide data for the following activity and allow students to investigate the concept of Energy_out.

**Activity 2: Where Does the Energy Go?**

Teacher note: Throughout the lessons in this supplement, we use the food calorie as the unit of energy. A food calorie, as listed on food labels, is the equivalent of 1,000 calories, or 1 kilocalorie (kcal). This is actually a unit of heat energy. One food calorie (1 kcal) is the amount of energy needed to raise a liter of water 1° Celsius at sea level. If you have covered heat energy previously and used the calorie unit, you may want to explain to students the difference between a food calorie and calorie as you used it previously.

For classes using the **Web-based version** of this activity:

Teacher note:

- This activity begins with students entering their personal energy-consumption data from their activity logs into a database on the Web. Students thus help establish a large data set, which they can use to evaluate their own activity levels. This large data set also allows students to generate and test hypotheses about energy use in middle school students in general.

- Students may need help with filling in the spreadsheet used to create the database. You will need to examine your school's computer and Web resources to determine the most effective way to enter data into the database. Can an entire class get computer access and enter data simultaneously? Can small groups access a few computers while the remainder of the class is working on other tasks? Will one person need to enter data for everyone?

- If students are going to enter their own data, it will save time to have the computers online and at the correct URL: http://science.education.nih.gov/supplements/energy/student. This is a main menu page from which you and students can access this activity (“Lesson 1—Burning It Up”). Students will need the unique identifier you established for their class to access the data entry and report menu pages.

- We recommend that data entry and discussion of the use of the database be completed during class. Students can then generate reports during class or from home.

- If students formulate hypotheses and generate reports during class, divide the class into groups of four to increase interaction and collaboration.
Teacher note: Testing most hypotheses will require students to generate more than one report.

Tip from the field test: Tell students to include their names on their hypotheses. For example, "Anna, Bryan, and Caitlin's hypothesis is that middle school students use more calories on weekend days than on school days." This will make it easier to distribute printed reports to the correct group.

14. After students have posed hypotheses and generated reports to test their hypotheses, they should summarize their findings in writing.

Do the data support or not support their hypothesis? What evidence are students using to form their conclusion?

15. Reconvene the class. Ask each group to share its results with the class.

Students should be encouraged to critique one another. Did members of another group use appropriate data to evaluate their hypothesis? On the basis of the reports generated, did the group draw correct conclusions?

16. As an extension activity, students can be assigned as homework the task of formulating another hypothesis, generating reports, analyzing whether the reports support or do not support the hypothesis, and submitting their results as a written report.

Teacher note: Students may be tempted to say a hypothesis has been proved or not proved. However, better terms are supported and not supported. In this activity, students draw conclusions on the basis of limited data collected for only two days. The results would be more reliable if data had been taken for a longer period of time. Scientists are hesitant to use the word proven. It indicates a very high degree of certainty. The key point to look for in the discussions is the evidence students use to support their conclusions.

In classrooms using the print version of this activity:

1. Ask students to have their completed physical activity diaries available. Ask students to add the total minutes they spent each day at each intensity level if they have not already done so.

Students should do this for the school day and the weekend day. They should check the accuracy of their diaries by adding the total number of minutes allotted to all activity levels. This should equal 1,440 minutes (60 minutes/hour × 24 hours/day).
2. Give each student a copy of Master 1.5, *Total Calories Used Per Day at Various Intensity Levels*. Ask students to copy the total minutes of activity at each intensity level from the last row of their two diaries (labeled *Total Minutes* on Masters 1.1 and 1.2) to the first row in the tables (labeled *Minutes of Activity*) on Master 1.5.

3. Guide students through the instructions at the top of Master 1.5 to allow them to calculate the calories used at each of the five intensity levels and the total calories used for both a school day and a weekend day.

Use a transparency of Master 1.5 to guide students through the calculations.

Tip from the field test: Students who forgot to complete their activity diaries should use data from one of their classmates so that the numbers are real student data rather than fabricated.

Teacher note: The energy values (cal/hour) used in this exercise are age-adjusted, average values that include the BMR. They provide only a rough estimate of each student's energy expenditure. To be more precise, the values would have to be activity-specific and adjusted for age, gender, and weight. This issue is addressed in Discussion Questions at the end of this lesson.

4. Draw two tables on the board, with the following headings:

<table>
<thead>
<tr>
<th>Resting &quot;Sleep&quot; (calories)</th>
<th>Very Light &quot;Sitting Activities&quot; (calories)</th>
<th>Light &quot;Walking Activities&quot; (calories)</th>
<th>Moderate &quot;Medium-Level Activities&quot; (calories)</th>
<th>Heavy &quot;High-Level Running Activities&quot; (calories)</th>
<th>Total Calories</th>
<th>Male (M) or Female (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Label one table *School Day* and the other *Weekend Day*.

5. Ask students to enter their summary data (bottom row of the table) from Master 1.5 into the two tables on the board. Also ask them to put an M in the last column for males and an F for females.

Because individual activity levels may vary widely, the data entry needs to be done with sensitivity. As an alternative, you can collect the diaries and prepare a summary table yourself. Retain a copy of the class data for later reference.
Tip from the field test: Distribute highlighter pens to students and suggest that they highlight the last row of each table on Master 1.5 (the summary data). This will help ensure that students enter the correct data on the board.

6. Ask students to count off using the numbers 1 through 12. Instruct students to calculate the class average for one table column based on their number.

Use the following code: students with numbers 1 to 6, school-day table; 1 = resting calories, 2 = very light calories, and so forth; and students with numbers 7 to 12, weekend-day table; 7 = resting calories, 8 = very light calories, and so forth.

Make sure students have the correct number of entries when they calculate the average values.

7. Ask students who have made the same calculation to compare answers and resolve any discrepancies before reporting results to the class.

8. Ask a representative of each student group to write the averages for each column on the board at the bottom of the appropriate column.

9. Tell students that they will make two bar graphs to analyze their results.

Students will construct one bar graph to compare their own physical activity data with the class averages for a school day and another graph for comparison with the weekend-day results.

10. Instruct students to graph calories on the y-axis. The x-axis will contain these categories: resting, very light, light, moderate, heavy, and total calories.

One bar in each category will represent the student's own results. The other bar represents the average class results. An example graph is presented here. Students can use two different colored pencils to distinguish their results from the average class results, or they can use other means to distinguish one bar from the other.

Graphing results in this way allows students to compare their energy (calories) used (total calories as well as calories in each activity intensity level) with the average results of the whole class. Students construct a similar graph for the weekend-day results.

Content Standard A:
Use appropriate tools and techniques to gather, analyze, and interpret data.
Teacher note: This activity introduces students to data analysis. This topic is addressed in greater detail in Lesson 4, where students explore the value of different types of graphs for analyzing data. Lesson 4 is a good time to discuss why bar graphs, and not line graphs, were appropriate for this activity.

11. Ask the class what questions they can ask that can be answered using these data. Can they formulate a hypothesis they can test using the class data?

There are several questions students could ask. For example, students might ask, "Do students have higher activity levels on weekends than on school days?" This question can be transformed into a hypothesis by rewording it as a statement: "Middle school students have higher activity levels on weekend days than on school days." Students could compare the average calories used for each activity level on the two days to test this hypothesis.

An alternative hypothesis, "Middle school students have higher activity levels on school days than on weekend days," is equally acceptable. A hypothesis is a statement that predicts a result. The statement is tentative because empirical evidence has not yet been obtained to support or contradict it. However, the statement is reasonable, because it is based on prior knowledge about the phenomenon. For example, some students may know that they spend more time doing outdoor chores and running around with friends on weekend days than on school days. For these students, the first hypothesis is reasonable. Other students may know that they spend more time watching TV and playing computer games on weekend days than on school days. For these students, the second hypothesis is reasonable.
The validity of either hypothesis is tested using data. The data will either support or not support the hypothesis. Many students think that a good hypothesis is one that the data support. In fact, neither hypothesis (one that the data support or one that the data do not support) is better. The important result is that students will have engaged in authentic scientific activity: they will have formulated a hypothesis and used data to determine whether their hypothesis is supported or not supported. Using empirical evidence to draw conclusions about phenomena is a key feature of science.

12. As a written assignment, ask students to formulate another hypothesis and then test their hypothesis using the data available.

Students may need to be reminded that their research questions need not deal only with total calories for all five activity-intensity levels. They might ask about changes in the distribution of activity intensity levels between the two days. Or, they might compare high-intensity activities with resting activities on the two days. Many different questions can be asked. Reports should contain a statement of the hypothesis, the data collected to test the hypothesis, and an evaluation and interpretation of the data. Students should indicate whether the data supported or did not support their hypothesis.

Teacher note: Information in the tables on the board allows students to compare results between males and females. To do this, students pool male and female results separately and calculate average values for each of these two groups.

Teacher note: Students may be tempted to say a hypothesis has been proved or not proved. However, better terms are supported and not supported. In this activity, students draw conclusions on the basis of limited data collected for only two days. The results would be more reliable if data had been taken for a longer period of time. Scientists are hesitant to use the word proven. It indicates a very high degree of certainty. The key point to look for in the discussions is the evidence students use to support their conclusions.

13. Ask the class what other questions they believe would be interesting to ask, even if they do not have the information to produce an answer. What additional information would they need to answer the question?

This allows students to use their imaginations. You might need to make some suggestions to get them going. For instance, students might want to know whether time of year has an effect on activity level. To answer this question, they would need information about the time of year the activity diary was kept. As an extension of this question, students might speculate about, or even investigate, the combined effects of geographical location and time of year.
Discussion Questions

1. Tables that list energy used for different activities (in calories per hour) usually include a statement similar to the following: "These values (calories/hour) are for an adult male who weighs 150 pounds." The values take into account a person's BMR. What might this statement tell you about BMR in different people?

   The statement correctly indicates that BMR values vary from person to person, and that BMR depends on the age, gender, and weight of the individual.

2. The total energy expenditures calculated by students are rough estimates of their actual energy expenditures. What would they need to do to make their estimates more accurate?

   They may respond that they should be more precise in determining how long they spend in each activity and that they should have better information available to determine the energy expended for specific activities. More importantly, they should recognize that they would need to take into account their age, gender, and weight in calculating energy expenditures.

   Teacher note: The BMR value is comparable to the energy used by a person who sleeps all day. Students may be interested in seeing how much of their total daily energy expenditure is due to BMR. If students would like to estimate their BMR, we recommend using a formula that accounts for differences due to age, gender, and weight.
   
   For males 10 to 18 years old, BMR = (17.5 × weight in kilograms) + 651
   For females 10 to 18 years old, BMR = (12.2 × weight in kilograms) + 746

   Pounds may be converted to kilograms by dividing weight in pounds by 2.2. For example a student who weighs 110 pounds would weigh about 46 kilograms (that is, 100 pounds ÷ 2.2 pounds per kilogram = 45.45 kilograms).

   To simplify the arithmetic, the formulas are
   For males 10 to 18 years old, BMR = (7.95 × weight in pounds) + 651
   For females 10 to 18 years old, BMR = (5.55 × weight in pounds) + 746

   One factor that is not accounted for in this equation is overall activity level. People who are more active have a slightly higher BMR than less active people. The BMR also decreases in starvation conditions. This is one reason why radical dieting is not recommended and is not as effective as gradual changes in diet and exercise.

3. Ask students to examine their physical activity diaries and look...
for patterns. Do they use more energy on weekend days or school days? What would happen to their energy consumption if they got two more hours of sleep every day? What would be the effect of watching TV for one hour less and doing one hour more of light or moderate activity?

This is a time for students to talk about choices they make. Which of their daily activities can they choose? Can they choose how active they are in school? What about how active they are after school? Be prepared for comments about homework being a Very Light Activity and taking time during which they could be more active. Suggest that students look at the amount of time they choose to watch television or play computer games.
Dear Me

Overview
This lesson consists of one activity. It begins with a classroom discussion in which students observe data that show the incidence of obesity increasing since 1985 and the risk of several diseases is higher for people with obesity. Then students are given a homework assignment. They write a letter to the person they will be in 25 to 30 years. They use what they have learned about energy balance to give themselves advice about appropriate strategies for maintaining energy balance (and thus a healthy weight) in their adult years.

Major Concepts
Obesity is increasing in the United States, leading to increased risk for many diseases. Maintaining the appropriate balance between energy intake and energy output is a lifelong goal. Middle school students should be in positive energy balance (Energy_in > Energy_out). For adults, Energy_in should equal Energy_out. Strategies can be developed to aid adults in achieving energy balance.

Objectives
After completing this activity, students will
- be able to explain obesity in terms of the energy balance equation,
- recognize that obesity is increasing in the United States,
- realize that many diseases are more likely to occur among overweight and obese individuals, and
- be able to describe strategies adults can use to maintain energy balance.

Teacher Background
See the following sections in Information about Energy Balance:
1. Introduction (pages 23-25)
2. The energy balance equation (pages 26-30)
3. Body mass index (BMI) (pages 30-31)
4. Factors affecting energy intake (pages 31-35)
5. Strategies for achieving and maintaining a healthy body weight and size (page 35)
In Advance

Web-Based Activity

<table>
<thead>
<tr>
<th>Activity</th>
<th>Web Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yes, only for obesity trends slides (see Procedure, Step 2)</td>
</tr>
</tbody>
</table>

Photocopies

<table>
<thead>
<tr>
<th>Activity 1</th>
</tr>
</thead>
</table>
| • Master 5.1, Obesity Trends, 1 transparency  
• Master 5.2, Increased Risk of Several Diseases with Overweight and Obesity, 1 transparency  
• Master 5.3, Letter to Myself, 1 transparency |

Materials

<table>
<thead>
<tr>
<th>Activity 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>none needed (except transparencies)</td>
</tr>
</tbody>
</table>

Preparation

None required.

Procedure

Assessment:
Asking students to explain obesity in terms of energy balance gives you an opportunity to evaluate students' ability to integrate what they have learned in Lessons 1 through 4. Students should use the terms Energy_{in} and Energy_{out} correctly to explain that obesity (and overweight) may result when adults

1. Begin this activity by giving students a simple definition of obesity: being significantly overweight for one's age, height, and gender due to increased body fat. Then ask students to explain obesity in terms of energy balance.

The National Institutes of Health defines obesity and overweight based on body mass index (BMI) as described in Section 3.3 in the Information about Energy Balance section. The BMI concept is not introduced to the students in this curriculum supplement.

2. Display transparency made from Master 5.1, Obesity Trends (or alternative described below).

If you have Internet access and a computer-screen projector in your classroom, you can go to the URL [http://science.education.nih.gov/supplements/energy/student](http://science.education.nih.gov/supplements/energy/student) and click on "Lesson 5—Dear Me." On the desktop, click on "Obesity Trends Maps" to display a series of maps that depict obesity in the United States every year from 1985 to 2002. (You can also download the maps as a series of PowerPoint slides at the URL [http://science.education.nih.gov/supplements/energy/guide/obesity-slides.ppt](http://science.education.nih.gov/supplements/energy/guide/obesity-slides.ppt). Click on "obesity-slides.ppt" to download the slides for classroom use.) The initial map on screen

122
presents data for 1985. Maps for subsequent years can be viewed in series by clicking the arrowhead just to the right of 2002. This advances the maps one year at a time. Clicking the arrowhead just to the left of 1985 goes back one year at a time. You may also click on individual years to go directly to that data if students need to review a specific year. To view the data in table form, click on “Obesity Trends Table” from the desktop.

3. Ask students to summarize what the maps reveal about obesity in the United States.

Students will likely say things like “Obesity is increasing” or “We’re getting fatter.” Accept these correct answers. You may want to add that nutritionists describe the trend they observed as an obesity epidemic because of the way obesity is rapidly increasing in the population.

4. Ask students to suggest reasons why doctors and other healthcare professionals are concerned about increasing obesity.

Students will likely identify several answers to this question, including the social stigma against overweight people and the negative impact of obesity on health. Healthcare professionals are concerned about the latter issue, and the rest of the discussion will focus on this.

Tip from the field test: Be sensitive to students’ feelings during this discussion. Overweight students, in particular, will likely be uncomfortable. Emphasize that healthy bodies come in many shapes and sizes. Obesity is a metabolic disease among adults that does not occur quickly. Physicians diagnose it on the basis of height and weight and/or amount of body fat (which can be challenging to determine), not simply by appearance.

5. Confirm that the negative impact of obesity on health is a major concern of healthcare professionals, including those at the National Institute of Diabetes and Digestion and Kidney Disorders, which sponsored this curriculum supplement. Then display a transparency made from Master 5.2, Increased Risk of Several Diseases with Overweight and Obesity.

This graph shows the increased risk of colon cancer, heart disease, and diabetes among people who are obese and overweight compared with the occurrence of those diseases among adults who are not overweight. Point out that the increased risk of developing diabetes among obese adults is so large that it does not fit on the graph. Discuss the rise in diabetes in overweight children, and point out that complications from diabetes are beginning to occur before they reach adulthood.

consume more calories in their food than they expend through BMR and physical activities (\(\text{Energy}_{\text{in}} > \text{Energy}_{\text{out}}\)). For children and adolescents, overweight may result when \(\text{Energy}_{\text{in}} > \text{Energy}_{\text{out}} + \text{Energy}_{\text{growth}} + \text{Energy}_{\text{stored}}\). Emphasize that this positive energy balance leads to obesity only if it occurs consistently across many months. As students saw in Lesson 3, 1 pound of body fat results from 3,500 calories in excess of what their body needs.

Content Standard F:
The results of risk analysis are used to determine the options for reducing or eliminating risks.

Content Standard C:
Disease is a breakdown in structure and functions of an organism.

123

Student Lesson 5
6. Ask students to draw conclusions from the graph.

Students should conclude that people are at increased risk of developing the diseases shown on the graph if they become overweight or obese.

7. Using the energy balance equation, ask students to describe what adults in the United States could do to reverse the obesity trend.

They should explain that adults need to reduce energy in, increase energy out, or both. Weight loss results when Energy_in < Energy_out.

8. Continue the discussion by asking students, “What challenges do you think adults face in maintaining energy balance?”

Students may describe challenges such as finding time to exercise and prepare healthy meals, large food portions at restaurants, and genetics.

9. Follow this by asking, “What strategies could adults use to maintain energy balance?”

Students may suggest strategies such as snacking on low-calorie foods, sharing restaurant meals with a friend or taking home extra food for later, or walking to work instead of driving. Because this question and the question in Step 8 have many “right” answers, this is an opportunity for all students to develop their discussion skills.

10. Assign students to use the class discussion as background for writing a four-paragraph letter to their 40-year-old selves that gives advice on maintaining energy balance. Display a transparency made from Master 5.3, Letter to Myself, which gives students the beginning of the first sentence for each paragraph.

Explain that you will collect their letters the next class period and will evaluate them based on their 1) description of an appropriate energy balance, 2) identification of challenges students are likely to face in achieving that balance, 3) strategies for managing calories consumed, and 4) strategies for managing calories used.