SAFTEY AND EPIDEMIOLOGY

**Essential Question:** *Do I Really Need to Wear a Helmet?*

**Learning Targets:**

Students will:

- Describe how a bicycle helmet prevents serious head injuries.
- Summarize data about accidents and traumatic brain injuries.
- Explain the most important reasons to wear a helmet.

**Lesson Overview**

Due to the very important safety considerations based on the foundational event in this unit, this lesson introduces the field of epidemiology, from the perspective of a Centers for Disease Control career data analyst. Many children and adults are resistant to the use of helmets when engaging in sports activities with a risk of violent impact to the head—skating, skiing, cycling, and skateboarding, to name a few. In order to reinforce the importance of helmet use, students will participate in a demonstration of the collision force on the head in an accident and how a helmet is designed to absorb the force.
Lesson Agenda

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Materials

- Young Allied Health Professional student packet
- Egghead helmet experiment (one per group)
- 3 eggs
- Stapler
- Tape
- A variety of cushioning materials per group, such as hard and soft foam (about 1 sq. yd. per class–purchase at any craft store), bubble wrap, packing peanuts, or pieces of padded mailing envelopes
- Large binder clips or paper clips
- Meter sticks
- Clear plastic sandwich bags or quart freezer bags
- Paper towel sections
- 5 Top Reasons to Wear a Helmet (to project)

FACILITATION NOTES

Expectations. Set expectations for behavior when students are conducting the egghead helmet experiment. You do not want raw egg all over your classroom.

Increase Helmet Use. Consider handing out bicycle and skateboard helmet fit guides for kids to take home. You could also invite a local Career-Based Outreach Program that offers free and low-cost helmets to use.

IN ADVANCE

- Be prepared to show the video, How Do Helmets Work? found at [https://www.youtube.com/watch?v=wF-Ft8FG2Mg](https://www.youtube.com/watch?v=wF-Ft8FG2Mg). This video is a humorous look at
the benefit of wearing a helmet if your head was a watermelon! The video is 3:54 minutes in length.

- To prepare for the Egghead Helmet Experiment, obtain foam, bubble wrap, packing peanuts and other materials for students to use in their model helmets. Obtain enough eggs so that you will have three eggs for each student group. This activity is written for teams of two, but to cut costs, you can have students work in teams of four instead. Decide whether you want to use raw or hard-boiled eggs, and prepare three eggs per student group. Boiled eggs crack more easily than raw ones but are obviously easier to clean up.

- The full lesson for the Egghead Helmet Experiment can be found at http://www.pbs.org/wgbh/nova/education/activities/0306_01_nsn.html. This site provides science background for you as a facilitator and also has extension ideas. Please read that information before teaching this lesson so that you are familiar with the science content.

**Vocabulary**

<table>
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<th>Content</th>
<th>Tier II</th>
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<td>force, acceleration</td>
<td>inference, iteration</td>
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**Opening (5 min)**

**Do Helmets Really Work?**

_In the previous lesson, we drew some conclusions about helmet use based on mystery data as Allied Health data analysts. Now, we will test those conclusions in an experiment to help us answer the question: Do helmets really work?_

1. **Project** the video &lt;How Do Helmets Work?&gt;: https://www.youtube.com/watch?v=wF-Ft8FG2Mg.
2. **Ask** students: How would you summarize how helmets work?
3. **Invite** students to turn and talk.
4. **Call** on volunteers to answer. **Listen for:** Helmets absorb and transfer the force to the whole of the helmet rather than the force occurring at one point on your head.
5. **Tell** the young professionals that they are now going to test the hypothesis they created in the role of data analyst and conduct their own experiment on if helmets work.
Work Time

The Egghead Experiment (35 min)

1. **Explain** to students that they will build models of bike helmets and will test the degree of protection their "helmets" provide to model "brains."

   - In this activity, a complete egg, including the shell, represents the brain; layers of paper towel and plastic bag surrounding the egg represent the skull and meninges, the layers of flesh around the brain.
   - An egg wrapped in a plastic bag plus paper towel represents a head.

2. **Distribute** the eggs, paper towels, plastic bags, cushioning materials and [Protecting Your Brain: The Egghead Bicycle Helmet] handout to student groups.

3. **Project** the data table.

4. **Model** the experiment with the first egg.

   - Note aloud that you are dropping (releasing) the egghead, not adding any force. As you increase the distance, model checking the egg after the drop.
   - Continue until the egg breaks.

5. **Invite** students to get into groups to build and test model "eggheads," following the directions on their handout.

6. **Remind** them to record their data after each drop.

7. When students have finished testing, **create** a class results table on the board or computer. Have each group of students enter their results (maximum height achieved with no injury/breakage for each helmet model). Have students compile average heights for each helmet model.

**Say:** Did wearing a helmet lower egghead fatalities? Often, the analysis of data leads to more questions. Do helmets really work, if bicyclist deaths increased even with the increase in helmet usage? The team of medical professionals designed research to investigate the helmet's ability to save lives. This research provides a test to the claim that helmets really work.

**Quick Write (10 min)**

1. **Project** the Quick Write questions:
In what ways were the “helmets” you designed and built good models of bike helmets? In what ways were they unrealistic models? Based on your experiment’s results, do helmets really work?

2. **Invite** students to respond to the Quick Write question in their notebooks.
3. **Tell** students to turn and pair share their responses.
4. **Use** equity sticks to cold call on students for their answers. **Listen for** answers that include but are not limited to: *The foam in the models serves the same purpose as the foam in a bicycle helmet. The models are unrealistic because the foam in a real helmet is denser and harder to compress. Also, bicycle helmets have several layers of protection (a hard outer shell) rather than one.*

**Closure (5 min)**

**Order It**

1. **Project** the list of the *<5 Top Reasons to Wear a Helmet>*.
2. **Tell** the students to follow the directions on the page.
3. **Invite** students to raise their hands and indicate their top reason for wearing a helmet.
4. **Tally** the class opinion.
SAFETY AND EPIDEMIOLOGY: Do I Really Need to Wear a Helmet?

Today’s Learning Objectives:

I can:

☐ Describe how a bicycle helmet prevents serious head injuries.
☐ Summarize data about accidents and traumatic brain injuries.
☐ Explain the most important reasons to wear a helmet.

Due to the very important safety considerations based on the foundational event in this unit, this lesson introduces the field of epidemiology, from the perspective of a Centers for Disease Control career data analyst. Many children and adults are resistant to the use of helmets when engaging in sports activities with a risk of violent impact to the head—skating, skiing, cycling, and skateboarding, to name a few. In order to reinforce the importance of helmet use, I will participate in a demonstration of the collision force on the head in an accident and how a helmet is designed to absorb the force.

Today’s Activities:

☐ Do Helmets Really Work?
☐ Egghead Experiment
☐ Quick Write
☐ Order It
Protecting Your Brain: The Egghead Bicycle Helmet

Your brain experiences countless forces every day of your life, in everything you do: running up the stairs, turning your head, even bumping your head against a cabinet door. But these activities don’t normally injure the brain. That’s because the skull and a series of protective membranes and fluids beneath it shield the brain from the bumps and other stresses of daily life. In a sudden impact, however, a sharp blow can cause serious injury to the brain. In this activity, you will investigate how model bicycle helmets provide protection from the forces generated during an impact, such as falling from a bike onto the pavement.

Procedure

Round 1—First Egg
1. Work with a partner. Place each of three eggs inside a plastic sandwich bag and then wrap each bag in two layers of paper towel. Staple or tape the paper towel layers to the sides and top of the bag. Leave a space on the top edge of the bag so you can peek in after each drop.
2. Drop one of these “eggheads” from a height of two centimeters. In the chart below, write “pass” if the egg survived the drop at that height, and “fail” if the egg cracked.
3. Increase the drop height by two centimeters. Repeat Step 2 and continue until the egg cracks.
4. On a separate sheet of paper, draw a table like the one below. Fill in the table for each drop.

Round 2—Second Egg
1. Use the materials your teacher provides to design and build a “helmet” to protect the second egg. Your goal is to develop a helmet that allows your egg to survive being dropped from the height that cracked the first egg.
2. Repeat Steps 2–4 from Round 1. You may make adjustments to the helmet between drops. Take notes on any changes you make to the helmet.

Round 3—Third Egg
1. Study your notes and results from Rounds 1 and 2. Design a new helmet to help your egg survive a drop from the height that cracked the second egg.
2. Repeat Steps 2–4 from Round 1. You may make adjustments to the helmet between drops. Take notes on any changes you make to the helmet.

Questions
1. Explain what the eggs, bags, and paper towels represent in your model. What does a cracked egg represent?
2. In what ways were the “helmets” you designed and built good models of bike helmets? In what ways were they unrealistic models?
3. What effect did additional padding have on the outcome of the egg drop? Why do you think padding made this difference?
4. What other types of data could you collect to understand more completely the factors that affect the brain during a sudden impact?
5. Bike helmets do reduce the risk of skull fractures and brain injuries. Yet, concussions are still common in sports in which helmets are worn. Why might this be the case?

<table>
<thead>
<tr>
<th>Height</th>
<th>Egg in bag with paper towel (&quot;egghead&quot;)</th>
<th>Egg with first helmet design</th>
<th>Egg with second helmet design</th>
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Note: Expand your table as needed to accommodate more heights for the drops.
Egghead Experiment Quick Write

1. In what ways were the "helmets" you designed and built good models of bike helmets?

___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

2. In what ways were they unrealistic models? Based on your experiment: Do helmets work?

___________________________________________________________________________
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___________________________________________________________________________
5 Top Reasons to Wear a Helmet

Order It! Give a rank order to which reasons to wear a helmet you find most important. A “1” indicates that it is your TOP reason to wear a helmet, and a “5” indicates that it is your least important reason.

Be prepared to explain why you ordered the reasons to wear a helmet the way you did.

_____ Visibility to drivers due to reflective material

_____ Protection from weather—sun and rain

_____ Avoid a ticket in the places that have helmet laws

_____ Prevent head injuries

_____ Set an example for others, like younger kids or siblings