Busy Bodies

Take a Breather

Grade 5 Sampler
The four cousins wandered by the huge swimming pool. While the others were talking, Ryan noticed one of the swimmers in the pool. She swam the entire length of the pool without surfacing for air! “Did you see that?” Ryan asked. “That swimmer must have great lungs!”

“I heard another swimmer saying he’d just finished 150 laps without stopping. I can only do eight without running out of breath,” remarked Dave.

“I wonder if having big lungs helps you to be a better swimmer,” said Magda. “Do bigger people have bigger lungs? And what about gender? Do men and women have the same size lungs?”

The cousins decided to test their own lungs to see who could hold the most air.

I wonder how much air my lungs can hold. I think at least a liter.

I’m bigger than you, so I think my lungs will be bigger too. I can probably hold two liters of air.

But how can we find out? Air is invisible. We can’t see how much we breathe.

If we get a full glass of water and breathe into it with a straw, water will spill over the edge of the glass. Maybe the amount of spilled water will be equal to the amount of air we blow into the glass.
EXPECTATIONS

- work as a group, respect each other and each other’s opinions, and work safely
- design and carry out an investigation to discover lung capacity
- measure and record results
- compare lung capacities and recognize the function of lungs
- recognize the organs of the respiratory system
- explain the connection between lung capacity and endurance

MATERIALS

- container of water
- straws and/or plastic tubing
- clear or translucent containers such as 4 qt (4 L) jars
- plastic bags
- balloons
- measuring devices – clearly marked in ounces (milliliters)
- resource books
- diagrams of the respiratory system

Investigate

Explore different ways to measure how much air lungs can hold. This is called lung capacity. Devise and carry out a plan to measure lung capacity within your small group.

THINK AND CONSIDER

- How do your lungs take air in and push it out? What other parts are involved in this process?
- What parts seem to move when you breathe deeply?
- Can you track the air in and out by making a diagram of the body?
- Try taking a very deep breath in (only one breath) and then breathe out every little bit. Do you breathe the same amount out?
- How can you catch the air you breathe out and measure it?
- When have you had the experience of blowing air into something? Could this be used to measure lung capacity?
- How does your lung capacity compare to that of your friends of the same sex and height?
- Are there sports where a better than average lung capacity gives you an advantage?
- How will you write your investigation in order to share and compare it with those of other groups?

Continuing the Learning

Does age affect the amount of air your lungs can hold? How would you conduct a fair test for this? Does gender affect the amount of air your lungs can hold? How would you conduct a fair test for this?
**FOR YOUR INFORMATION**

We all need air. We cannot live without the oxygen that is in the air we breathe.

The main function of the lungs is to bring oxygen into the body by breathing in and to let carbon dioxide out when breathing out.

Our respiratory system works by oxygen entering through the nose or mouth, moving down the windpipe (trachea), which then branches into two tubes (bronchi), each leading to a lung. The bronchi branch into smaller tubes that branch into small air sacs. In the air sacs, oxygen from the air is transferred to the blood and carbon dioxide, a waste product, is taken by the blood to the lungs and removed through our nose or mouth when we exhale.

**LUNG CAPACITY**

The average 5 ft (155 cm) tall girl has a lung capacity close to 3 qt (3 L). The average 4 ft 6 in (137 cm) tall boy has a lung capacity of about 2 qt (2 L).

**RELATED BOOKS**

*Respiratory System*  
by Alvin Silverstein et al

*Respiratory System*  
by Darlene Stille

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**Key Understandings**

- designs and implements an investigation to measure lung capacity
- recognizes that the lungs are part of a breathing system called the respiratory system

**INQUIRY AND DESIGN SKILLS**

exploring, investigating, interpreting, communicating, evaluating, reflecting

**Introducing the Learning**

Present the scenario to the class. Begin a discussion by asking questions such as the following.

Have you ever heard the phrase, “a good set of lungs”?  
For what sports do you think it would be really important to have great lung capacity?  
What do you think of the cousins’ ideas for measuring the capacity of lungs?

Introduce the investigation to the students and provide time for groups to discuss the *Think and Consider* questions and share ideas about what they will try. Encourage students to use a *Design Sheet* (BLM 7) to record their findings and to use resource books for illustrations of the respiratory system.

**Interacting with the Learning**

What are your plans for the investigation to this point?  
How have you used a resource book to assist you?  
What difficulties have you encountered?  
How did you solve them?  
What did you have to modify in your plan to achieve your goal of finding lung capacity?

**Consolidating the Learning**

What did you find out about measuring lung capacity?  
What kinds of materials worked best in getting an accurate result?  
How did your plan differ from those of others?  
Is there one best way to measure lung capacity?  
What surprised you about your results? Did they match predictions?  
How do lungs fit into the respiratory system?  
What other parts are involved? How?
What kinds of sports require better-than-average lung capacity? Why is it important to know about lung capacity?

**Observing for the Learning**

Does the student …
- discuss and make a plan with the whole group?
- try to find resource materials, either print or from the Internet?
- gather materials in advance?
- build a device to measure lung capacity?
- repeat the investigation to verify results?
- record observations and measurements?
- measure accurately?
- show a curiosity to investigate further?
- appreciate the contribution of the ideas of others within the group?

**Strategies for Assessing the Learning**

1. **Teacher Observation Rating Scale** (BLM 24)
2. **Inquiry Rating Scale** (BLM 26) for Continuing the Learning
3. **Journal Entry**
   - I was really surprised by this investigation when …

**Connecting the Curriculum**

**MATHEMATICS CONNECTION**

- Consider using a computer spreadsheet for this activity. Chart the lung capacity of a segment of the class, for example, boys or girls or those of a certain age. Findings can be presented through a line or bar graph. Calculate the average lung capacity of that group of students.

**HEALTH AND PHYSICAL EDUCATION CONNECTIONS**

- Create a model of the lungs. Show how the lungs are affected adversely by smoking.
- Investigate how many breaths you take in one minute when sitting still. Repeat this at least five times, calculate the average, and record it. Now jog on the spot or do some other strenuous exercise for about five minutes and check your breathing rate. How does it compare to your average rate when at rest? Have others do the same; try to include some top-conditioned athletes. How do their breathing rates compare with yours? Chart the results in your science journal.
- Estimate and find out the capacity of different containers using a milliliter measuring container. Find and list items at home that are measured in liters or milliliters. What is common about the items on the list?

**PROTOTYPE INVESTIGATION**

It is important to encourage students to be inventive and devise their own plans. Some students may try exhaling air into a plastic bag, squeezing it into a shape, and then marking it off with a marker. This will give a rough estimate. Others may blow up a balloon as best as they can with one full breath and then measure the circumference. Others may blow a very light object a distance and then measure that distance. While the latter two do not measure capacity, they give an idea of it. Do not underestimate the students’ creativity in devising plans that will work.

For those students who have a difficult time conceiving of a way to measure lung capacity, you may want to suggest the standard investigation using a 4 qt (4 L) jar (or a 2 qt (2 L) soda bottle with the top cut off) filled with water immersed upside down in a sink or pan of water (hold hand over opening upon immersing). Plastic tubing is inserted into the mouth of the jar while immersed. Students take as deep a breath as possible and then breathe into the tube. The amount of water displaced by forcing air in can be recorded by marking clearly the level of water now in the jar. To measure the capacity of the water displaced, simply empty the jar and measure the amount it takes to fill the jar to the noted mark. This is the capacity of the lungs of the participant.

Note: if you wish several students to use the same setup, attach a straw to the tubing. Make sure it is well sealed to prevent air leakage.
**MATHEMATICS CONCEPTS**

- identifies relationships between and among measurement concepts
- estimates, measures, and records the capacity of containers
- predicts the validity of the results of data collected
- interprets displays of data and presents the information using mathematical terms

**SCIENCE/SCIENCE AND TECHNOLOGY CONCEPT**

- explains how the health of human beings is affected by environmental factors

**SCIENCE/SCIENCE AND TECHNOLOGY CONNECTIONS**

- Find out about the smog index factor from weather reports. In what areas in your country do people need to concern themselves about such a factor? Why is this so? How can smog affect our respiratory system? What regulations has your government passed to protect citizens from smog?
- What other environmental factors will affect a person’s respiratory system?

**SOCIAL STUDIES CONNECTION**

- Research to find out what is meant by an “iron lung.” When was it developed?
We would like you to notice …
## Observation Rating Scale for

### Levels:
- **4** – Independently and goes beyond by challenging self; Thoroughly
- **3** – Independently; Successfully
- **2** – With some assistance; Partially
- **1** – With assistance; Rarely

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### INQUIRY RATING SCALE

**Levels:**
- 4 – Outstanding; Thoroughly
- 3 – Consistently; Successfully
- 2 – Developing; Partially
- 1 – With assistance; Rarely

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<th>NAMES</th>
<th>Does the student …</th>
<th>begin the investigation by asking questions?</th>
<th>identify needs/problems before beginning the investigation?</th>
<th>explore possible answers and solutions to questions?</th>
<th>plan an investigation for one of the possible solutions?</th>
<th>identify variables that need to be held constant to make the investigation fair?</th>
<th>identify criteria for assessing the investigation?</th>
<th>carry out the investigation (following a plan)?</th>
<th>measure with accuracy (measure more than once if necessary)?</th>
<th>gather and record the data in a meaningful way?</th>
<th>reflect on and apply the learning?</th>
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