



Lacking Lovely Lungs

A Lesson on Respiration

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Lesson # 9

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PURPOSE	The purpose of this activity is to understand the difference between obstructive and restrictive lung disorders and how they affect respiration.
OBJECTIVES	Upon completion of this activity, students will be able to: <ul style="list-style-type: none">• classify lung disorders as obstructive or restrictive.• describe the effects specific lung disorders have on respiratory function.• measure peak expiratory flow and make comparisons to respiration when using lung disorder models.• communicate valid conclusions about lung disorders.• identify causes of lung disorders.• design and implement an investigative procedure using a conceptual model.• construct graphs, tables, and charts using tools including computers to organize, examine, and evaluate data.
GRADE LEVEL	7 th and 8 th grade
PRIOR KNOWLEDGE	Students should understand that the human body is composed of many organ systems. The respiratory system is one of those systems that must function properly in order to maintain homeostasis.
TIME REQUIRED	If done in its entirety, eight 45-minute class periods.
INCLUDING ALL STUDENTS	<ul style="list-style-type: none">• Divide the class into heterogeneous groups, with some male and female students in each group.• Allow students with respiratory illnesses, such as asthma, to take a “management” or data recording role.• Student groups can choose their own disease to research and build a conceptual model.• Student groups can choose a variety of materials, with teacher approval, to create their conceptual model. <p><i>This lesson engages students with the following learning styles or methods:</i></p> <ul style="list-style-type: none">• kinesthetic: rotating through classroom using student-made models• tactile: creating and using conceptual models• small group: KWL charts, Illustrated vocabulary• cooperative group: model construction and testing, and• whole class lecture: illustrated vocabulary definitions
QUESTIONS TO ASK ALONG THE WAY	<ul style="list-style-type: none">• Explain the difference between an obstructive and restrictive lung disorder.• Give two examples of an obstructive disorder and two examples of a restrictive disorder.• How will your model test the type of disease you are simulating?• How will you measure how your device affects respiration?• How will your group record your data (chart, graph, table)?

**NATIONAL
SCIENCE
EDUCATION
STANDARDS**

K-12 Unifying Concepts and Processes
Evidence, models and explanation

Grades 5-8

K-12 Unifying Concepts and Processes

Systems, order, and organization
Evidence, models, and explanation
Change, constancy, and measurement
Form and function

Science as Inquiry

Abilities necessary to do scientific inquiry
Understanding about scientific inquiry

Life Science

Structure and function in living system
Regulation and behavior
Diversity and adaptations of living organisms

Science and Technology

Abilities of technological design

Science in Personal and Social Perspectives

Personal health
Natural hazards, such as air pollution and contaminants
Science and technology in society

**TEXAS
STATE
SCIENCE
EDUCATION
STANDARDS**

Texas Essential Knowledge and Skills:

7.1 A-B

7.2 A-E

7.3 A-C

7.9 A-B

7.10 A-C

MATERIALS

- Computer with Internet access and spreadsheet (e.g., Excel)
- Spirometer such as Vernier's (see Resource #1), Lungometer (see Resource #2), or Student Dry Spirometer (see Resource #3)
- Materials for creating conceptual models. Students should decide which materials they will use, but the teacher may provide things such as plastic tubing, PVC pipe, straws of various diameters, marshmallows, pom-poms, ping pong balls, party favor horns, paper bags, French bread paper bags, rubber bands, balloons, baggies, belts, string, etc.
- digital camera
- meter sticks
- handouts per student group:
 - Vernier Spirometer lab OR Lungometer lab
 - Lacking Lovely Lungs instructions
 - Internet Treasure Hunt
 - "Prescription for Treatment" (found in the resources section)
- handouts per pair of students:
 - KWL chart
- handouts per student:
 - Illustrated Vocabulary Chart
- poster board
- markers
- coffee stirrers
- belts with buckles (10-12)
- baggies
- latex balloons
- thin rubber band
- thick rubber band

SAFETY

- In this activity, students are simulating respiratory disorders. If a student is suffering from any respiratory disorder, they should observe others using the conceptual models, and refrain from trying it themselves.
- Students should get teacher approval for their model design and materials list to make certain they are safe.
- If students design a model that requires breathing into it, sanitizing procedures must be given and followed after each student uses the model.

PREPARATION **DAY 1**

AND

PROCEDURE

1. The day the activity is introduced, the teacher will perform the following quick simulations to demonstrate abilities of **lungs affected by restrictive or obstructive lung disorders** compared to **lungs without disorders**:
 - a. Pull a thick rubber band back and release it, saying only, "Healthy lung." Pull a thin, flimsy rubber band back and release it, saying only, "Unhealthy lung." This represents elasticity and lack of elasticity in healthy and unhealthy lungs.
 - b. Inflate a latex balloon then release it, saying only, "Healthy lung." Inflate a plastic baggie then release it, saying only, "Unhealthy lung." This represents the lung's ability to exhale efficiently and inefficiently.
 - c. Have students inhale a normal breath, then exhale through a coffee stirrer. Tell the class, "Obstructive." Have students in pairs put a belt across one partner's chest, tightening it just enough to feel slight pressure. Instruct the student with the belt across his chest to take a deep breath in, then exhale. Say to the class, "Restrictive." Partners should trade roles and repeat the procedure. This represents obstructions preventing efficient exhalations and restrictions preventing efficient inhalations.
2. **KWL** : Have students complete the "What I know" and "What I want to know" sections to **explore restrictive and obstructive lung disorders**. As students finish adding comments to their charts, they can add them to an electronic chart for class viewing using the wireless keyboard, or add them to a poster that the class can view.

As comments are added to the class chart, students may also add to their own charts. Students should keep their charts to use as a reflection piece at the end of all of the activities.

DAY 2

As a whole class, complete the definition section of the **Illustrated Vocabulary activity** (found in the resources section)

Because these are terms students are probably unfamiliar with, I suggest giving them the definitions (provided in resources section). Students will then work in partners to complete the "In my own words" and "Illustration," which can be a drawing of the definition, or an example of the definition, sections of the **Illustrated Vocabulary activity**.

PREPARATION DAY 3

AND

PROCEDURE

Once students have a basic understanding of respiration and the respiratory system, they will measure and record their total lung capacity (also called vital lung capacity) using either the Vernier software (preferred, Vernier computer interface, and LoggerPro to complete Lab 19, Lung Volumes and Capacities) or the Lungometer. **This will determine total lung capacity (TLC) which will be used to compare respiration through the conceptual models**

After the Vernier probes have recorded the TLC for each student, have students record their data on a class chart created with Excel. A bar graph for the class will be constructed, with each student represented by his own bar. One color should be used for the girls' bars and a different color for the boys' bars. A bar with the average for the girls and a bar with the average for the boys are recommended so a visual comparison between male and female TLC can easily be made.

DAY 4

Assign each group of students (4 per group) either "Restrictive" or "Obstructive." The group will complete the **Internet Treasure Hunt** (found in the resources section) on a specific disorder that is classified as the type (restrictive or obstructive) they have been assigned.

DAYS 5 and 6

Using the suggested materials in the "Materials" section, and any other materials approved by the teacher, students will design a conceptual model to simulate respiration with the disease students researched in the **Internet Treasure Hunt**. The students must draw a design and have it approved by the teacher before construction begins. **Students must have a method for measuring expiratory reserve volume, vital lung capacity, and/or inspiratory capacity (they can refer back to their Illustrated Vocabulary for clarification of these terms) in the lung disorder model so that it can be compared to students' TLC.**

EXAMPLES (NOT to be shared with students):

- Measuring the distance a pom-pom can be blown by exhaling through different diameters of straws (obstructive lung disorder).
- Using a spirometer or Lungometer to create smaller breathing passages (i.e. cap or block part of mouthpiece) and measure TLC (obstructive lung disorder).
- Using a belt to apply light pressure around chest. Measure diameter of chest after inhaling, but before exhaling. Repeat the procedure without the belt (restrictive lung disorder).
- Inflating a balloon normally with one breath and measuring the diameter of the balloon. Use a belt to apply light pressure around chest and repeat the procedure (restrictive lung disorder).

Once teacher approval is given, student groups will construct their models.

- PREPARATION AND PROCEDURE** ***To ensure the model will collect accurate data:***
- a) the group designing the model must use the model to collect data on their group, and
 - b) make revisions to their model based on the collected data BEFORE it is tested by other groups.

Then, students must write instructions on how to use the model and how to measure and record data (some sort of table or chart is recommended so a quick visual comparison can be made).

DAYS 7 and 8

1. Student groups will give a 4-5 minute presentation after constructing their models. Each presentation should include:
 - Internet research findings on obstructive and restrictive lung disorders.
 - Internet research findings on the disease researched, including its cause and how it debilitates.
 - Explanation on the model constructed and how it would simulate the disease researched by the group.
 - Explanation of how to use the model, how to measure data, and the method to record the data (chart, table, graph)
2. After all presentations have been given, students will rotate around the room, testing student made models and recording their data.
3. When each student has tested and recorded data from each model (with the exception of those students afflicted with a respiratory disorder), a class chart/table/graph will be created. This will be patterned after the chart/table/graph each group created for recording the data obtained by using their model. There will be a class chart/table/graph for each model (e.g. 8 groups=8 class chart/tables/graphs). Boys and girls should be different colors on the charts/tables/graphs, so a comparison can be made between genders. If time is a factor, the teacher can compile the class charts/tables/graphs for use the next day.
4. Display the charts charts/tables/graphs created for each model. Use them to have a class discussion. Some questions asked might be:
 - Which disease(s) based on the data collected by this class might affect the diameter of the lungs? How would it affect the diameter?
 - Which disease(s) based on the data collected by this class might affect the lung tissue? How would it affect the tissue?
 - What difference do you notice between the TLC of males and females?
 - Does height play a role in TLC? How?
 - What other factors might affect the data obtained from the models? A person's TLC? (asthma, just exercised, athlete VS non-athlete)
 - How do these models compare to the demonstrations shown at the beginning of this unit?
5. Have student fill in the "What I learned ..." section of their KWL chart. Add student comments to the class chart started at the beginning of the unit, and encourage students to fill in those comments on their own charts

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- WHERE TO GO FROM HERE**
- Invite a respiratory therapist to visit your campus. Ask them to bring equipment they use when treating patients.
 - Have students complete “Prescription for Treatment” handout found in the resources section.
 - Use any program that allows to students to interact electronically by posting comments and questions, to bring focus to an online chat. Create a poll asking students which disease presented to them by their classmates they thought was the most debilitating. Post discussion starter questions.
 - Contact the American Lung Association to request informational pamphlets that students can take home and discuss with their families.
 - Organize a respiratory health fair, with students presenting their models and information about the disease they researched.
- SUGGESTIONS FOR ASSESSMENT**
- Students will be assessed through:
- KWL chart
 - Vernier Spirometer Lab or Lungometer Lab
 - Student presentations (rubric in resources section)
 - Illustrated Vocabulary Chart
 - Exit slips where students comment on one interesting thing they learned or what they enjoyed most about the activities (these can vary depending on what activity you did that day)
 - “Prescription for Treatment” (optional extension activity in resources section)
 - Discussion board posts (optional extension activity)
- REFERENCES AND RESOURCES**
1. *Make a Lungometer*
<http://www.the-aps.org/education/mhmw/pdf/lungometer2.pdf>
A link to a My Health, My World lesson found on the American Physiological Society website giving directions on how to use a lungometer and how to interpret data from its use. Accessed December 03, 2009.
 2. *Vernier Spirometer*
<http://vernier.com/probes/probes.html?spr-bta&template=standard.html>
A link to the Vernier website which provides information on ordering the spirometer probe and correlating software. Accessed December 03, 2009.
 3. *Portable Dry Spirometer*
<http://www.carolina.com/product/portable+dry+spirometer.do?keyword=spirometer&sortby=bestMatches>
A link to Carolina Biological Supply which provides information on ordering a dry spirometer and disposable mouthpieces. Accessed December 03, 2009.

OVERVIEW:

You have been hired by General Hospital to invent a model to help people understand what it is like to live with a respiratory disorder. You must find out everything you can about either a restrictive or obstructive lung disorder. Your group will design a model that simulates what it is like to breathe with a respiratory illness that is the type you are assigned, either obstructive or restrictive. Your classmates will try your model so they can measure how respiration is affected by your disorder, so give very clear instructions on how to use your model. Remember, you will be “paid” in points- the better you follow instructions, the more you earn! Keep reading to make sure you meet all of the guidelines!

BEFORE THE BUILDING BEGINS:

By the time you begin designing your model, you will have completed:

- The K&W on a KWL
- Illustrated Vocabulary
- Vernier Spirometer or Lungometer Lab
- Internet Treasure Hunts (2)

Use these assignments to help you with information when creating your model.

INTERENT TREASURE HUNTS:

While completing the Internet Treasure Hunt on your assigned respiratory disorder type (obstructive or restrictive), you will decide which disease you want to research. The disease you choose to research is the disease you will make your respiratory model after. You will complete a second Internet Treasure Hunt on the disease your group selects.

COLLECTING YOUR BUILDING MATERIALS:

Using the materials provided by your teacher or materials you bring from home (ALL materials must be approved by the teacher), you will design a model that simulates what respiration with the disease you researched would be like.

DESIGNING YOUR MODEL:

Draw a design and have it approved by your teacher **BEFORE** you begin construction. Your model must have some way of measuring expiratory reserve volume, total lung capacity (also known as vital lung capacity), and/or inspiratory capacity so that it can be compared to students' normal total lung capacity. **WHAT IS BEING MEASURED DEPENDS ON THE TYPE OF DISEASE YOU RESEARCHED!** If you are simulating an obstructive disorder, you will most likely measure expiratory reserve volume and/or total lung capacity. If you are simulating a restrictive disorder, you will most likely measure total lung capacity or inspiratory capacity. Refer back to your illustrated vocabulary for definitions if you need to!

TEAMWORK:

Every person in the group must have a job! Choose from the following. If you have your own suggestions for jobs, ask your teacher about them!

- **Manager:** keeps group focused and on schedule; asks the teacher questions after the group has tried to come up with a solution.
- **Materials Manager:** gets supplies from teacher.
- **Maintenance Director:** organizes clean up, keeps work area organized and clean.
- **Recorder:** writes information, records data.

ALL MEMBERS ARE REQUIRED TO HELP WITH RESEARCH, DESIGN, AND CONSTRUCTION OF MODEL!

BUILDING YOUR MODEL:

After the design for your model is approved, you may begin construction. To ensure the model will collect accurate data:

- a) your group must use the model to collect data on your group, and
- b) make revisions to your model based on the collected data **BEFORE** it is tested by other groups.

In addition to building a model and testing it before it is used by classmates, you must write very detailed instructions on how to use your model, and create a chart, graph, or table that students will use to record the data obtained from using your model. If your model requires students to blow into it or put their mouth on it, make sure you have a method approved by your teacher for sanitizing the model after each student uses it!

PRESENTING YOUR MODEL:

When your model and instructions for its use are completed, each group will give a 4-5 minute presentation. Your presentation must include the following:

- Internet research findings on obstructive and restrictive lung disorders
- Internet research findings on the disease researched, including its cause and how it debilitates
- Explanation on the model constructed and how it would simulate the disease researched by the group
- Explanation of how to use the model, how to measure data, and the method to record the data (chart, table, graph)

TESTING OTHER MODELS:

When all of the presentations have been given, you will experience what it would be like to have the lung disorders your classmates have researched by trying the models they created. Don't forget to follow their instructions on how to use the model and record your data! You will start with your model, and rotate on your teacher's signal.

The data from each model will be compiled into one class chart/table/graph. Follow your teacher's instructions on how to add your data to the class chart/table/graph.



What I Know

What I Want to Know

What I Learned

Name

Date

Period

Topic of Discussion: Obstructive lung disorders		
What I Know about this topic/question	What I Want to know about this topic/question	What I Learned about this topic/question



What I Know

What I Want to Know

What I Learned

Name

Date

Period

Topic of Discussion: Restrictive lung disorders		
What I Know about this topic/question	What I Want to know about this topic/question	What I Learned about this topic/question

**RESPIRATION ILLUSTRATED VOCABULARY
(WITH DEFINITIONS)**

TERM	DEFINITION	IN MY WORDS...	ILLUSTRATION
EXPIRATORY RESERVE VOLUME	The amount of air that can be exhaled following normal inspiration		
INSPIRATORY CAPACITY	The amount of air that can be inspired following normal exhalation		
MINUTE VENTILATION	Total amount of air moved in and out of the lungs in one minute		
RESPIRATORY RATE	Breaths per minute		
TIDAL VOLUME	Amount of air breathed in and out in one breath cycle		
VITAL CAPACITY/ TOTAL LUNG CAPACITY	The largest amount of air that can be moved in and out of the lungs		

**RESPIRATION ILLUSTRATED VOCABULARY
(WITHOUT DEFINITIONS)**

TERM	DEFINITION	IN MY WORDS...	ILLUSTRATION
EXPIRATORY RESERVE VOLUME			
INSPIRATORY CAPACITY			
MINUTE VENTILATION			
RESPIRATORY RATE			
TIDAL VOLUME			
VITAL CAPACITY/ TOTAL LUNG CAPACITY			

Group members: _____

Disease: _____

Lacking Lovely Lungs Rubric

PRESENTATION (20 points):

Presented research findings on Obstructive or Restrictive lung disorder (5 pts) _____

Presented research findings on disease, including cause and how it debilitates (5 pts) _____

Clearly explained model and how it simulates disease researched (5 pts) _____

Clearly explained how to use model, how to measure data from model,
and how to record data (5 pts) _____

MODEL (80 points):

Simulates obstructive or restrictive lung disorder (20 pts) _____

Clear instructions on how to use the model are given (20 pts) _____

Chart, Table, or Graph created to record data (20 pts) _____

Students able to use model and obtain data (20 pts) _____

TOTAL (= GRADE ON THIS PROJECT): _____

Internet Treasure Hunt

Name: _____ Date: _____

This web info search will help you find information about restrictive and obstructive lung disorders. You will be looking at pre-selected web sites to answer each question. It is important to not only find the information at the site, but also to consider who wrote the site, what their purpose is in writing it, and how credible (accurate) you think the information is.

Question 1: What is a restrictive lung disorder? What is an obstructive lung disorder?		
	Site 1 <i>Obstructive Lung Disease</i> http://en.wikipedia.org/wiki/Obstructive_lung_disease	Site 2 <i>Restrictive Lung Disease</i> http://www.medcentral.org/body.cfm?id=184
Who created this web site (organization, etc.)?		
Why did they create it? (check all that apply)	<input type="checkbox"/> To provide factual information <input type="checkbox"/> To influence the reader's opinion <input type="checkbox"/> To sell a product or service <input type="checkbox"/> I'm not sure	<input type="checkbox"/> To provide factual information <input type="checkbox"/> To influence the reader's opinion <input type="checkbox"/> To sell a product or service <input type="checkbox"/> I'm not sure
How credible (accurate) do you think the info is?	<input type="checkbox"/> Very accurate <input type="checkbox"/> Somewhat accurate <input type="checkbox"/> Not very accurate <input type="checkbox"/> I'm not sure	<input type="checkbox"/> Very accurate <input type="checkbox"/> Somewhat accurate <input type="checkbox"/> Not very accurate <input type="checkbox"/> I'm not sure
What did you learn?		

Internet Treasure Hunt

Name: _____ Date: _____

This web info search will help you find information about specific lung disorders classified as either restrictive or obstructive. You will be looking at pre-selected web sites to answer each question. It is important to not only find the information at the site, but also to consider who wrote the site, what their purpose is in writing it, and how credible (accurate) you think the information is.

Question 2: Explain a specific restrictive or obstructive lung disorder, including its cause.		
	Site 1 <i>Lung Disease Alphabetical Listing</i> www.lungusa.org/lung-disease/list.html	Site 2 <i>Lung Diseases and Disorders</i> www.medic8.com/lung-disorders/index.htm
Who created this web site (organization, etc.)?		
Why did they create it? (check all that apply)	<input type="checkbox"/> To provide factual information <input type="checkbox"/> To influence the reader's opinion <input type="checkbox"/> To sell a product or service <input type="checkbox"/> I'm not sure	<input type="checkbox"/> To provide factual information <input type="checkbox"/> To influence the reader's opinion <input type="checkbox"/> To sell a product or service <input type="checkbox"/> I'm not sure
How credible (accurate) do you think the info is?	<input type="checkbox"/> Very accurate <input type="checkbox"/> Somewhat accurate <input type="checkbox"/> Not very accurate <input type="checkbox"/> I'm not sure	<input type="checkbox"/> Very accurate <input type="checkbox"/> Somewhat accurate <input type="checkbox"/> Not very accurate <input type="checkbox"/> I'm not sure
What did you learn?		

Prescription for Treatment

Patient Name: _____

Doctor's Name: _____

Type of respiratory disorder:

Description of illness:

Illness caused by:

Rx (treatment suggestions):

Physician's Signature: _____

Date: _____

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