Activity Introduction:

Have you ever had a cold or choked on a piece of food and weren’t able to breathe freely? It is an uncomfortable and scary feeling when we are not able to breathe normally. Fortunately, for most of us breathing happens regularly without ever having to think about it – because breathing is regulated for us by our brains. With breathing seeming to be so easy, we often take it for granted. For many people with lung disease, however, normal breathing just is not possible and this can have a serious impact on their daily lives.

Problem Statement:

What is the effect of restricted breathing on the ability to recall a list of words?

Background:

There are four basic processes involved in respiration. The first process is breathing or ventilation. The second is the exchange of carbon dioxide and oxygen in the alveoli of the lungs. The third process is circulation of blood between the lungs and the body tissues. The last process is the carbon dioxide and oxygen exchange that occurs between the blood and body tissues. Normal ventilation (breathing) is the mechanical movement of air in and out of the lungs, without an obstruction. The air that moves in and out of the lungs contains oxygen, which is essential for the cells in our body. Without oxygen, our cells cannot get the energy they need to stay alive and to function properly.

It is in the lungs that gas exchange occurs; oxygen is moved from the air into the blood and carbon dioxide is moved out of the blood into the air. During this gas exchange, oxygen and carbon dioxide diffuse through the walls of tiny sacs called alveoli. These walls are only one cell thick and are very moist with water. The gasses (carbon dioxide and oxygen) dissolve in the water and are then able to pass through the alveoli walls.

If a person has an obstructive lung disorder or a restrictive lung disorder then major breathing problems can result. Obstructive lung disorders occur when airflow is blocked and restrictive lung disorders occur when lung volume is reduced. Examples of obstructive lung disorders are asthma, bronchitis, or cystic fibrosis. Asthma is the narrowing of the airways; bronchitis is inflammation of the airways and cystic fibrosis is a genetic disease that clogs the airways by an overproduction of mucus. An example of a restrictive lung disorder would be emphysema. Emphysema is caused mainly by smoking or other environmental particulates that damage the alveoli sacs, causing them to lose their elasticity. Because breathing is an involuntary action controlled by the brain, we do not have to think about it and are free to concentrate on other tasks. In this activity, you will investigate the effect of restricted and obstructed breathing on your ability to perform simple tasks. In the first part of the investigation, you will have a chance to experience what it is like to have one of these breathing problems.
Simulating an Obstructive or Restrictive Lung Disease

Read all directions and check off each instruction as it is completed.

IF YOU HAVE ASTHMA OR OTHER BREATHING PROBLEMS, DO NOT PARTICIPATE IN THIS ACTIVITY. YOU CAN LEARN BY OBSERVING OTHER STUDENTS.

☐ 1. Clear everything off your desk. You will receive a noseclip, paper towel and a straw. Immediately place the paper towel on your desk and put the nose clip and straw on the paper towel.

☐ 2. Put the nose clips on your nose and place the straws in your mouth, breathing through your mouth until the simulation begins.

☐ 3. Once the simulation begins, you will breathe only through the straw.

☐ 4. You will breathe through the straw for 1 minute. After 1 minute passes, your teacher will say “Stop”. Place your straw on the paper towel on your desk.

☐ 5. Now, stand quietly by your desk with your nose clip in place. Once again, you will breathe through the straw for 1 minute, but this time, you will run in place while breathing through the straw. Pick up the straw and place it in your mouth. When the teacher tells you to begin, breathe through the straw and run in place next to your desk. After 1 minute passes, your teacher will say “Stop”. At that point, sit down and put your straw and nose clip on paper towel on your desk.

☐ 6. Now, complete the Venn Diagram included with the Student Data Page, comparing and contrasting Restricted Breathing with Unrestricted Breathing. You may add to your Venn Diagram after you complete the rest of the investigation.

☐ 7. Listen as your teacher explains the procedure for the next part of your investigation. This part of the investigation is an experiment. This means that there is an independent variable that is being changed by the experimenter and a dependent variable that may change in response to the action of the independent variable. Once you understand the experiment, identify the independent and dependent variables in this experiment and write them on the Student Data Page. You will also identify three variables held constant in the experiment.

**Hypothesis:**

Now that you have read the background information and your teacher has explained the procedure to you, you will make an hypothesis that predicts how restricted breathing might affect your ability to recall words from a word list.
Materials:
- Small diameter plastic drinking straws such as coffee stirrers or cocktail straws (enough for each student to have one straw)
- 1 nose clip (Can use swimmer’s nose clips such as Aqua Explorers series-model E1950 or disposable nose clips available from Medical supply companies)
- Stopwatch
- Paper Towels
- 1 copy of Student Answer Page

Experiment Instructions:

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Read all instructions and check off each instruction as it is completed.

☐ 1. Now that you have experienced what it is like to breathe with obstructed or restricted airways, you will conduct an experiment to see how this type of disease might affect your ability to recall words from a word list.

☐ 2. Leave your nose clip and straw on the paper towel on your desk. Close your eyes and listen as your teacher reads a list of words at the rate of 1 word per second. When all the words have been read, you will have 5 minutes to write down as many words as you can remember. Write these words on your Student Data Page in the space entitled Unrestricted Breathing Word List.

☐ 3. Now, place your nose clip on your nose, breathe through the straw, close your eyes and listen to a second list of words, read at the rate of 1 word per second. Remove the nose clips and straws and place them on the paper towels on your desk. You will have 5 minutes to write down all the words from the second list that you can remember. Write these words on your Student Data Page in the space entitled Restricted Breathing Word List.

☐ 4. A student will bring a container to your desk. Place your nose clip in the container. For sanitary reasons, DO NOT HANDLE NOSE CLIPS USED BY OTHERS.

☐ 5. A student will bring the trash can to your desk so you can throw away your straw and paper towel.

☐ 6. Your teacher will help you collect class data needed to complete your Student Data Page. Record this data in the Student Data Page tables entitled Number Students in Class vs. Number of Words Recalled for Unrestricted Breathing and Restricted Breathing and Number of Students in Class vs. Number of Extra Words Written for Unrestricted Breathing and Restricted Breathing.