

**Grade 5 - Exploring the Respiratory System: Understanding Structure
and Function**

Navjit Klair
Teacher Candidate (J/I), Wilfrid Laurier University
June 2024

Learning Outcomes

In this lesson, students will achieve learning outcomes aligned with, '*AI. STEM Investigation and Communication Skills*' and will be able to describe the basic function and structure of the respiratory system and its vital organs. Students will use an engineering design process to create a lung model to observe how the diaphragm facilitates inhalation and exhalation. When the diaphragm (represented by the balloon knotted at the bottom) is pulled down, the space inside the model increases, decreasing the pressure inside, which in turn causes the lungs (two balloons inside the bottle) to inflate. When the diaphragm is pushed up, the space inside the model decreases, which increases the air pressure in the bottle, causing the balloons to deflate.

This lesson is designed to promote a student-centered and exploratory approach to understanding the respiratory system. By encouraging students to guess what various materials represent based on the video they watched and the image in front of them, they engage in active learning and critical thinking. For example, they will collaborate within their groups to guess what the bottle, straws, balloons, and bottom balloon might symbolize in relation to the respiratory system. The opportunity to explore and manipulate the materials allows students to construct their own understanding of how these components could be combined to represent the respiratory system. If students make mistakes during this process, they gain valuable learning experiences by identifying and correcting these errors, which in turn deepens their understanding and reinforces their critical thinking skills.

Additionally, the lesson ends with a guided inquiry and discussion, where students are provided with a worksheet to label diagrams and draw parallels between their models and the actual respiratory system. As the teacher explains the different organs, students will label the diagrams

and compare them with their own lung models, reinforcing their understanding of each organ's structure and function. By physically pointing to parts of their models that correspond to the organs being discussed, students make connections between the concepts being explained by the teacher and the tangible models in front of them. This process of drawing parallels helps solidify their knowledge by linking visual, kinesthetic, and auditory learning modalities.

This hands-on, inquiry-based, approach not only makes learning more engaging but also promotes collaboration and communication as students share their ideas with the class. Through this process, they develop essential scientific skills, such as hypothesizing, experimenting, and communicating their findings, which are key outcomes of the lesson. By the end of the lesson, students will be able to explain how the respiratory system functions, describe its basic structure, and identify the roles of key organs such as the nose, mouth, lungs, trachea, and diaphragm.

Grade and Strand

Grade: 5	Curriculum Area: Science
Strand: Life Systems	Unit: Human Health and Body Systems

Curriculum Expectations

Overall Expectations:

- **A1. STEM Investigation and Communication Skills:** use a scientific research process, a scientific experimentation process, and an engineering design process to conduct investigations, following appropriate health and safety procedures

- **B2.** Exploring and Understanding Concepts: demonstrate an understanding of the structure and function of human body systems and interactions within and between systems

Specific Expectations:

- **A1.1.** use a scientific research process and associated skills to conduct investigations
- **A1.4.** follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials
- **A1.5** communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes
- **B2.1.** identify systems of the human body, and describe their basic function
- **B2.2.** describe the basic structure and function of vital organs in various systems in
- the human body

Prior Learning:

- Prior to this lesson, students would benefit from being familiar with the concept that the human body is made up of various systems. Having a general idea of where the major organs are located within the body would make it easier for them to construct the lung model. Also, having awareness that different organs play specific roles in the body for the systems to function correctly is important.

Materials

Note: The materials listed below are recommended based on the grade level and the teacher's discretion for what best suits their class. Instead of using duct tape, teachers may opt to provide students with playdough for sealing gaps in the model. Using playdough can reduce the amount of tape needed and offers students the opportunity for careful, repeated observations and modifications to assess the functionality of their model.

Please refer to the 'Resources' section for instructions on how to pre-cut and pre-tape the materials.

Materials (per student):

- Disposable empty transparent bottle (295- 480 milliliters) made of hard plastic (such as a sports drink bottle), with the bottle cap, precut by the teacher
- Bottle cap (teacher will have cut a hole at the top prior to the lesson)
- 1 straw
- Duct tape
- Exacto-knife (to only be used by the teacher to pre-cut materials)
- 3 balloons (8-inch balloons work well)
- Pencil
- [Worksheet](#) (one for each student)
- [Image](#) (one for each student)

Students can collaboratively work in their groups but will be creating a lung model individually or in pairs. If in pairs, they can select who they would like to work with. They will be doing this activity at their desks.

Lesson

Estimated Time Needed: 90 minutes

Handouts: Image and Worksheet

This lesson uses *Bybee's 5E Instructional Model* to give students a structured framework, helping them connect their experiences to the taught concept, and then applying their learning to new contexts. By structuring the lesson around exploration, explanation, and elaboration, teachers prioritize the “process” over simply finding the correct answer, which fosters deeper comprehension and skill development in students. Through this approach, students not only grasp the concepts, but also build their own understanding of the respiratory system. By engaging in hands-on activities and group discussions, they take charge of their learning process, enhancing their comprehension of the topic.

Engage:

- Get students to close their eyes and take a deep breath in and out, telling them to pay attention to how their chest rises and falls.
- Then get them to hold their breath for as long as they can.
- Ask them how it felt. Did they feel uncomfortable? Did it get harder as time went on? Does anyone know why? Provide the answer once a couple of students have guessed.
Answer: “Our body needs oxygen to survive and when we hold our breath, we aren’t breathing in the oxygen anymore, depriving our body of that essential element.”
- Ask students if they know what oxygen is and based on what we have talked about so far, what body system they think we will be learning about.
- Ask them what they think the respiratory system does and what the main organs are.

- *“Today, we'll learn how our lungs work and about the different parts of the respiratory system. Our lungs help us breathe in the oxygen our body needs and gets rid of carbon dioxide, which is the waste product our body makes. It also helps us talk, shout, scream, and laugh.”*
- Play the following [YouTube video](#) (hyperlinked) to introduce them to the respiratory system, what it does, and the vital organs.
 - Pause the video once something important is said and repeat it to students, to ensure they are understanding what is being said.

Explore:

- Place the materials students will need to build the lung models in front of them, along with the [image](#) (hyperlinked) they will be using to help them along the way.
- Give them time to work together to explore and think about how the materials placed in front of them could be combined to represent the respiratory system; thinking back to the video they watched and the image in front of them.
- While the students are working, the teacher should be walking around the classroom, encouraging students to think creatively and to work with one another. Instead of giving answers, the teacher should be giving them a slight push in the right direction. This approach uses a ‘Thinking Classroom’ strategy, promoting critical thinking and problem-solving skills. This places emphasis on the process rather than the answer itself.
- Once the majority of the class has created a model, students share what they created and their interpretation of the respiratory system. Students are then given time to change their

model if they wish to do so, based on what their peers did, before the teacher demonstrates how to make the lung model step-by-step.

- Then the teacher will give students time to explore through guided inquiry and class wide discussion what they notice at each stage:
 - *Gently pull down the knot, what happens? Why do you think that is?*
 - *Let the knot come back to its neutral position, what happens?*
 - *Gently push the knot into the bottle, what happens?*
 - *Blow into the straw, what happens?*
 - *How do you think this may resemble breathing?*

Explain:

- As the teacher answers the questions asked during the ‘Explore’ phase, they will ask students to place their hands on their chest and see if they can feel their ribcage expanding and contracting.
- *“Let’s take a closer look at our model. This part right here, the bottle, is like our chest cavity. And this straw is like our windpipe, or trachea. It helps the air travel in and out of our lungs. When you pulled the knot down, the space inside the bottle increased and your balloon probably filled up with air. In the same way, when the diaphragm in our body pulls back, the chest cavity increases and air flows into our lungs, and we inhale. When you pushed the knot in, the space inside the bottle decreased, and the balloon probably deflated. In the same way, when the diaphragm relaxes the chest cavity space decreases, and air is pushed out of the lungs, and we exhale. And when you blew air into the straw the balloons inflated, just like when we forcefully breathe, air comes into our lungs, and they expand.”*

- As the teacher is explaining, they could use the [image](#) (hyperlinked), to provide students with a visual, along with the lung model to help enhance their understanding (verbally, visually, and kinesthetically).
- Students are provided with a [worksheet](#) (hyperlinked), and as the teacher explains the different organs, students should label the diagrams and draw parallels between the model they created and the actual respiratory system.
- As the different organs are being explained, the teacher should be getting students to point at their own lung models and their own bodies.
- The below highlighted organs are the most important ones that we want learners to know about.

“Now let’s discover the important organs and what they do. As we go along let’s label and make connections with our actual respiratory system and our model”:

- **Nose** → Serves as an entry point for the respiratory system, it warms up, humidifies, and cleans up the air before it reaches the lungs
- **Mouth** → Just like the nose, it is an entry point and also warms up and humidifies the air. It doesn’t have the same elaborate system for filtering out particles as the nose does, but it still traps some larger particles such as dust and debris
- Then the air continues down to the pharynx → The pharynx, commonly called the throat, is where the two airways of the mouth and nose meet. It is like a passage that connects your nose and mouth to your windpipe (trachea). It helps direct the air you breathe and the food you eat to the right places in your body.

- Then the air goes to the larynx → The larynx is also known as the voice box, and it is located right at the top of the trachea (windpipe) and contains your vocal cords. So, it is responsible for producing sound when you speak, sing, and laugh.
- Next is your **trachea** (10-12 cm long) → Also known as your windpipe, it is like a tube that carries the air from your nose and mouth down into your chest.
- The trachea then splits into two **bronchi**, one for each lung
- The bronchi then split into smaller and smaller tubes, called bronchioles, that have tiny air sacs at their end called alveoli. We have millions of alveoli in our lungs! These sacs have thin walls, so thin that oxygen and carbon dioxide can pass through them and enter or leave our blood. The blood transports oxygen to almost every part of the body. The blood also gives the carbon dioxide a ride back to the lungs.
- The **diaphragm** is located under the lungs and helps you breathe. When you breathe in, your diaphragm lowers and your rib muscles expand, increasing the space in your chest cavity. This allows air to move into your lungs. When you breathe out, the diaphragm moves back up into its neutral position, while the rib cage contracts, this motion pushes the air out of your lungs.
- Ask the following questions at the end of the lesson:
 - *So now, based on everything you learned, what would happen if you didn't breathe for a few minutes?*
 - *How is the model different from our actual respiratory system?*
 - *What could have been done differently to better represent the system?*
- By engaging with the provided worksheet, students consolidate their learning of the respiratory system as they compare and contrast their model with the actual anatomy.

This activity encourages students to identify similarities and differences between their model and the real respiratory system, deepening their comprehension of the topic.

Elaborate:

- A follow-up activity that could be done to get students to elaborate their learning is getting them to research disorders/diseases that influence a specific organ in the respiratory system and ways to prevent this disorder. They would work in groups and through this would be able to identify the differences between a healthy respiratory system vs an unhealthy one.
 - This allows for cross-disciplinary learning as it incorporates both science and health and physical education. Students will have already learned about the respiratory system, exploring the scientific aspects, such as identifying the organs and their functions, and can now learn about maintaining its health. By researching potential disorders that may arise in this system, they examine the choices we make, including aspects of diet and physical fitness, allowing them to understand the interconnectedness between science and health.
- Students could also mimic a lung infection in their lung model by coating the body of the balloons (lungs) with corn syrup. They could then try manipulating the model in different ways and note down what they noticed with the balloons prior to and after the ‘lung infection’.
 - Teachers can follow the link below to learn more about how to lead this activity:
<https://www.sciencebuddies.org/stem-activities/infected-lung>

Evaluation:

‘2 Minute Review’:

<https://letstalkscience.ca/educational-resources/teaching-stem/two-minute-review>

- After each segment of information, students pair up with a neighbor. One student summarizes what was covered, as if their partner missed the class, while the other listens. Then, the listener reiterates the summary, adding any missed information. The teacher addresses any confusions or uncertainties before moving on to the next segment, where the process repeats.
- Assessment for & as learning: By summarizing and discussing the material with a partner, students consolidate their understanding, identify areas of confusion, and clarify concepts as needed. This ongoing feedback loop allows teachers to gauge student comprehension and adjust instruction.

- **‘Science Notebooks’:**

<https://www.calacademy.org/educators/setting-up-your-science-notebooks>

- These notebooks can be introduced at the beginning of the unit and integrated into their daily routines. In the notebook, one page can be dedicated to each system, where students draw diagrams, add notes, and note down any strategies for maintaining the health of each system and any disorders or illness associated with it. At the end of each lesson, students can be given 5-10 minutes to update their notebooks.
- Assessment for learning: Teachers can regularly review the notebook and provide feedback, identifying student strengths, areas of improvement, and misconceptions. This lets the teacher know how much students are understanding

(are they getting the key points?) and how to improve future instruction (slow down, reteach, speed up).

- Assessment as learning: Students are reflecting and consolidating their own learning. As they update their notebook regularly, they are assessing their own comprehension and can set goals on how to further improve their understanding.

● Circulating the Classroom

- Assessment for learning: During the 'Explore' phase the teacher should be moving around the classroom, providing immediate feedback and guiding students. By randomly asking students questions about the model they're working on, the teacher gets immediate insight on how well each student understands the respiratory system. This insight helps the teacher tailor their support to each student's needs.

- The teacher could use a *Checkbric*, observational checklist and/or anecdotal notes.

● Hand Gestures

- Assessment for learning: During the 'Explain' phase, the teacher could ask students to show their level of understanding by using a thumbs-up, horizontal thumbs, or thumbs-down gesture. This helps the teacher identify which concepts students find challenging, which in turn informs instructional decisions.

Safety Considerations

- Students must be briefed prior to being provided the materials on how to safely handle scissors, sharp objects, and what to do if an injury/accident does occur (make the teacher aware right away).
- The teacher should also go through the importance of germs and not blowing on each other's straws.
- The teacher and students should be aware that some people are highly sensitive or allergic to the latex in balloons. These students can be accommodated by using non-latex balloons.
- All the bottles and caps will be pre-cut and taped to ensure no sharp edges are visible. Students will be instructed to let the teacher know immediately if any of the tape becomes undone.
- Throughout the activity, the teacher will ensure that students are handling materials and tools carefully to avoid accidents or injuries. Remind students not to put balloons or small objects in their mouths to prevent choking hazards.

Environmental Considerations

- Choosing bottles that are reusable or recyclable to minimize waste.
- Encouraging students to use only the amount of tape, balloons, and other supplies needed for the activity.

Considerations For Differentiation

- Providing alternative cutting tools or pre-cut material for students with fine motor skill challenges.
- Allowing students to pair up if needed, so they work off one another's strengths.

- Offering an alternative project for students who may struggle with the hands-on aspect.
For example, they can create a presentation or create a digital model.
- Having a range of materials if students cannot work with specific materials (ex. Latex-free balloons).
- Providing step-by-step instructions, visual aids, and written instructions to support all students (visual, written, and oral).
- Taking into consideration different learning preferences:
 - In the lesson there is a video, verbal instruction, kinesthetic activity, and a written component.
- Providing students with a worksheet with all the organs listed and diagrams for them to label, to reduce recall, confusion, and promote effective use of vocabulary.
- Allowing students who may need extra time to complete the activity to work at their own pace. Also providing these students the option to stay in at lunch if they require one-on-one instruction.

Equity, Diversity, and Inclusion

- Using inclusive language and getting students to collaborate with one another so they can learn from each other and share their diverse perspectives.
- Providing alternative materials, formats, and instruction for students with disabilities or language barriers.
- As the unit develops, the teacher can teach students about the Indigenous perspectives on health and wellness, including the traditional understandings of the respiratory system and breathing practices.

Resources

[Lungs Working Model – School Science Project:](#)

This source provides the teacher with step-by-step instructions on how to create the lung model. Before the lesson, teachers should watch the above linked video to understand the required materials and pre-cut and pre-tape items as directed to ensure the safety of students. Teachers can decide how much they want to prepare and how hands-on and creative they want students to be, based on the class level and time available.

[How Do We Breathe – Science Buddies](#)

This Science Buddies link is used to generate ideas for guiding students and providing additional prompts during the exploration part of the activity. The content from the provided link helps to structure discussions and encourage deeper engagement with the topic.

[Lungs and Respiratory System – Kids Health](#)

This source provides us with in-depth knowledge of the respiratory system and was used in the ‘Explain’ section of the lesson to provide accurate information to students about the different vital organs and their roles.

[Explore How Lung Infection Influences Breathing – Science Buddies](#)

This source can be used by teachers as a follow-up activity. This source provides all materials required, prompts to guide students, answers, and step-by-step instructions. Once students understand how a healthy respiratory system functions, the teacher can use this source to mimic a lung infection and help students understand what happens to the respiratory system during an infection.

[Travel through the Respiratory System – Smile and Learn](#)

This video is used to introduce students to the respiratory system and provide them with information before they delve into creating their own lung models.

[Image – Vendantu](#)

This image visually shows students what is happening to our lungs, diaphragm, and chest cavity when we inhale and exhale. It's given to students as they begin creating their own lung models, serving as a helpful guide, and introducing them to the vocabulary they'll encounter during the activity.

[Respiratory System Worksheet – Canva](#)

I created this worksheet, inspired by the one I saw on the *Science Buddies* link. It includes an image of a lung model, an image of the respiratory system, and a word bank. Students consolidate their learning of the respiratory system as they compare and contrast their model with the actual anatomy.

References:

- Bybee, R. W. (2015). *The BSCS 5E Instructional Model*. NSTA press.
<https://static.nsta.org/pdfs/samples/PB356Xweb.pdf>
- California Academy of Sciences. (n.d.). *Setting up your science notebooks*.
<https://www.calacademy.org/educators/setting-up-your-science-notebooks>
- De Brabandere, S. (2020). *How do we breathe? | STEM activity*. Science Buddies.
<https://www.sciencebuddies.org/stem-activities/lung-model>
- De Brabandere, S. (2020a). *Explore how lung infection influences breathing | stem activity*. Science Buddies. <https://www.sciencebuddies.org/stem-activities/infected-lung>
- Hirsch, L. (Ed.). (2022, July). *Lungs and respiratory system (for parents) | nemours kidshealth*. KidsHealth.
<https://kidshealth.org/en/parents/lungs.html#:~:text=What%20Are%20the%20Parts%20of,windpipe%2C%20lungs%2C%20and%20diaphragm.>
- Let's Talk Science. (2023). *Two minute review*.
<https://letstalkscience.ca/educational-resources/teaching-stem/two-minute-review>
- Ontario Ministry of Education. (n.d.). *Science and Technology*. The Ontario Curriculum, Grades 1 - 8: Science and Technology.
<https://www.dcp.edu.gov.on.ca/en/curriculum/science-technology>
- Smile and Learn. (2017, March 23). *Travel through the respiratory system - FUN science for kids*. YouTube.
https://www.youtube.com/watch?v=X2YVt16Kxak&ab_channel=SmileandLearn-English
- The Amaze Lab. (2020, May 11). *Lungs working model | school science project*. YouTube.
https://www.youtube.com/watch?v=I2rDyTQQhXo&ab_channel=TheAmazeLab
- Vedantu. (2024). *Human respiratory system - diagram, features, parts and functions*. Vedantu.
<https://www.vedantu.com/biology/human-respiratory-system>