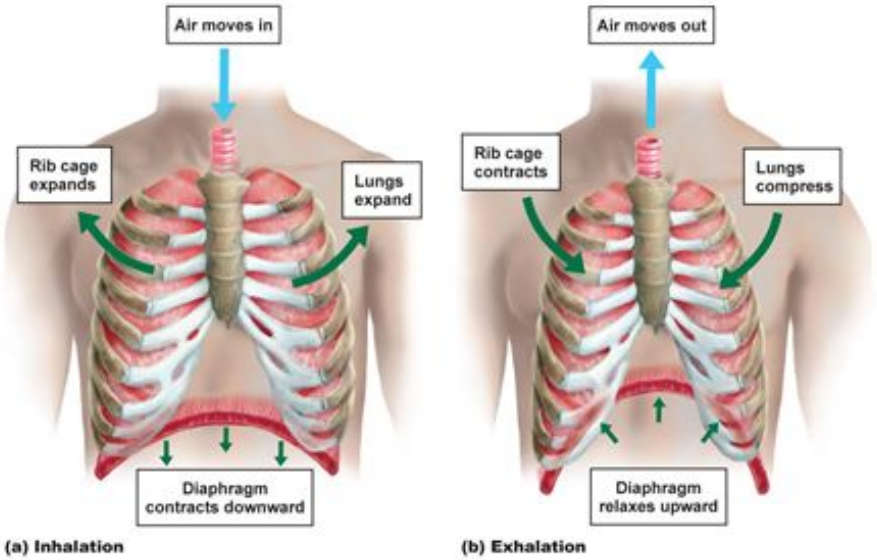
Lesson Plan in Teaching Reasoning

Learning Objectives	At the end of the activity, the students must be able to: 1. Explain how the respiratory system works. 2. Design a model that can simulate how respiration works in the human body. 3. Discuss how the respiratory system works or interacts with the other system of the body.
Subject Matter	A. Topic: The Respiratory System at Work Subtopic: Human body system works together. B. Learning Assessment: B.1. Group discussion- the students will be having a brainstorming activity with their group mates on how respiration works and how it interacts to the other human body systems. B.2. Group Presentation- the students will present their model in front of the class. They will also make a claim that aligns to the topic with supporting evidence. C. Time Frame: 2 hours
Learning Concept	The Respiration Process: - During inspiration (inhalation), the diaphragm and intercostal muscles contract. - During exhalation (expiration), these muscles relax. The diaphragm domes upwards. 
Material/s	2- Liter plastic bottles, straws, a string, tape, balloons, tape, rubber band, cutter, a pair of scissors, clay

Procedure

Part A: Brainstorming Activity

1. The students will be grouped into at least 3 to 5 members each, followed by a discussion on how the respiratory system works. The teacher will post the following guide questions:
    a. How does our respiratory system work?
    b. How are the other human body systems working together to get air in and out of the body?
2. Allow the students to brainstorm their answers along with their group mates. Tell the students to discuss their prior knowledge of the human respiratory system by using a physical model of the human body.
3. Encourage them to think and dig deeper into concepts. Once they already have an idea how to develop high quality questions, the teacher can work with them to decide whether the questions are testable or researchable.

Part B: Constructing Model

4. Distribute to each group the activity paper, including the description of the activity and the materials needed in the construction of the model. Then, asked each group to construct a model that simulates how the respiratory system works. Let the students make predictions as they discuss with their group mates on the best model to simulate the process of respiration.
5. Move from one group to another and ask the students to explain and justify why their model was constructed in that way. Scaffold the thinking of the students. For instance, ask them what the balloon represents, or let them explain how their model works.

Part C: Construct Arguments

6. Engage the students in using the model as a vehicle to craft a scientific argument that consists of claims and evidence.
7. Encourage them to use their model to generate their qualitative description and make a justified reasoning. Provide a guideline for the written group argument.

Question	How does our respiratory system work?
Claim	What inferences can I make based on my model? (Make sure your claim relates to the idea that the human body system works together, it answers the guide questions, and is based on your model. Provide one sentence that can lead to your evidence.)
Evidence	How do I know? Justify your claim by providing data and reasoning for it from your model. (You are trying to convince your readers that your model can explain a phenomenon and how it

	responds to the guide questions. You should make connections to the idea that the human body system works together, class experiences, investigations, and outside resources. Do not restate your experimental observations. Your explanations should focus on why and how the system works.)

Sample of student's first written argument.

Claim	The respiratory system helps to move the air entering the mouth to the lungs.
Evidence	That process for breathing is in your mouth, through the windpipe, and into your lungs. We use straw to represent the windpipe and the balloons to represent the lungs. The bottle can be our rib cage. We can blow to make the lungs well up.

8. Monitor the students' progression by asking them probing questions, such as "What evidence from your model explains the relationship between the lungs and chest?" or "What aspects of your model or explanation might your classmates find confusing or questionable when we discuss your model?".
9. Ensure that the students can express the relationship between their model, claim, and evidence and that those aspects have congruence.

   <u>Part D: Group Presentation</u>
10. Require the students to present their models and arguments in a whole-class discussion setting and receive feedback from other groups. In this way, it helps the students recognize the strengths and weaknesses of their own models and arguments, and fosters subsequent rounds of revision.
11. In this part of the activity, the students usually can explain each part of the respiratory system, but their model may not be able to explain how the respiratory system works. They usually do not pay attention to the function and role of the diaphragm in the respiratory system. To stimulate students' thinking about the function of the diaphragm, you can ask: "How does the diaphragm help our lungs expand and contract?" or "We do not blow to make the lungs swell up! How do our lungs work?"
12. As the rounds of revision progress, ensure that students not only can see and express the parts within the system but also can model and articulate how the system collectively works. This classroom effort typically requires several rounds of re-envisioning, revising, and negotiating with and among small groups and whole-class discussions.

13. Provide an opportunity for the students to compare their current models and arguments using other resource materials such as their textbooks or internet resources. In this process, the students are able to develop a more comprehensive understanding of the scientific vocabulary and use that vocabulary in their modeling, presentations, discussions, and individual writing.

    Sample of student's written argument.

Claim	Human body systems work together to get air in and out of the body.
Evidence	We use the straw to represent the windpipe and the balloons to represent the lungs. The bottle can be our rib cage. The muscles help get air in and out of the body. The muscles surrounding the lungs tense when you breathe in and spread out so the lungs relax and the parts that were pushed away so the lungs can expand are not getting pushed to the side so the lungs can expand. Another muscle that helps is the diaphragm, the diaphragm helps in the same way that the muscles surrounding the lungs do. It pushes the lower part of the body down so the lungs have room to expand downward. The diaphragm also does this: when the diaphragm goes down, there isn't so much pressure on the lungs so the lungs can get full of air but when the diaphragm goes up, there is so much pressure that it pushes the air out of the lungs.
Reasoning	Pressure is an important function supporting respiration. A pressure gradient is required to generate respiration flow. In spontaneous respiration, inspiratory flow is achieved by creating a sub-atmospheric pressure in the alveoli by increasing the volume of the thoracic cavity under the action of the inspiratory muscles. During expiration, the intra-alveolar pressure becomes slightly higher than atmospheric pressure and gas flow to the mouth results. Boyle's law describes the relationship between volume and pressure in a gas at a constant temperature. Boyle discovered that the pressure of a gas is inversely proportional to its volume: If volume increases, pressure decreases. Likewise, if volume decreases, pressure increases.

14. Use the writing activity to evaluate students' breadth and depth of understanding of the topic, and what additional experiences they might need to advance their understanding.

Questions and Analysis	1. Ask the students to write down their generalizations or individual reflections about the activity.

Argumentation Rubric

Level	Relevance (Does your evidence support your claim?)	Sufficiency (Do you have enough evidence?)	Connecting Reasoning (Do you connect your claim to your evidence?)	Science Ideas (Do you use science ideas to justify your evidence?)
1	Student does not provide evidence supporting the claim.	Student provides no evidence (observations or measurements).	Student does not provide any connections between their evidence and the claim.	Student provides no science ideas or science ideas provided are incorrect.
2	Student provides a mixture of supporting evidence as well as non-supporting evidence to support the claim.	Student provides one piece of evidence (observations or measurements) *but more evidence is needed to support the claim.*	Student connects some, but not all evidence to the claim.	Student provides some correct science ideas that are *not* relevant to the claim.
3	Student provides mostly supporting evidence which supports the claim.	Student provides one piece of evidence (observations or measurements) to support the claim.	Student connects all of the evidence to the claim but the connections are vague or insufficient	Student provides a relevant science concept or term, but does not explain it and how it relates to the claim.
4	Student limits all of the evidence to that which is relevant to the science in the claim and supports the relationship in the claim.	Student provides at least two pieces of evidence that fully support the claim.	Student connects all of the evidence to the claim sufficiently and clearly	Student provides a relevant science concept that is correctly explained.