



Subject: Physical Science

Grade Level: Middle/High School

DI Strategy: Tiered Scaffolding

Conduction of Heat Lab Scaffolding Lesson

I found that scaffolding was especially helpful in my co-taught physical science classes. In these classes I had a wide range of learners and each learned best in a different way. It was my goal to provide the scaffolding needed to challenge all learners and ensure that no one fell behind. I also tried to incorporate several ways for students to express work to keep all learners interested.

The project below was completed by students after learning about conduction. They were presented with a variety of materials and posed with a challenge: to determine how to heat up two mugs of hot chocolate using only one burner and the materials provided. This project served to determine student understanding of not only conduction, but how conductors and insulators work. Since they had already learned about conduction, this was a summative assessment of their learning and I used it to determine if students were ready to move on to the next type of heat transfer, or if some students needed additional review. In order to accurately assess their understanding, students created a visual to show how they would achieve the goal and had to write a paragraph in order to explain how the set-up would work. There were two different options for the writing portion, each that contained scaffolds but one having more scaffolding than the other. The first option was to write the paragraph using the direction sheet and a rubric. The rubric specified for students what needed to be included, such as the vocabulary terms needed. The other option required that students include the same information, but had more scaffolding. This scaffolding included having students define vocabulary terms and included prompts for students to answer about their set-up. My co-teacher and I determined which students would need the additional scaffolding on the second option and which would receive the first option by giving them a short formative assessment at the end of the previous class period.

Regardless of the option given to the student, all students conveyed the same information. This information was then used to determine the level of mastery that the student had over the material. Below are the two options as well as the direction sheet that all students received.



Hot Chocolate Lab-Direction Sheet

Objectives

- Relate conduction to a real world problem
- Investigate heat transfer of insulators and conductors

Your Mission

Imagine this: You are camping in the Poconos with your best friend. It is a cool night so you and your friend decide to warm up with some hot chocolate. Unfortunately, you only brought one tiny burner and some glass mugs. Using only the materials at your campsite (the materials on the front desk), how could you heat up both of your mugs of hot chocolate?

In order to come up with your solution, you must first do some research. Please follow the directions below and answer the questions to guide you through this process.

1. Read your research:

Conduction is one of the ways that energy is transferred from the earth's atmosphere to the air. **Conduction is the process by which heat energy is transmitted through collisions between neighboring molecules.**

Think of a frying pan set over an open camp stove. The fire's heat causes molecules in the pan to vibrate faster, making it hotter. These vibrating molecules collide with their neighboring molecules, making them also vibrate faster. This process continues until the entire pan has heated up due to the vibrating and colliding molecules. If you've ever touched the metal handle of a hot pan without a potholder, you have first-hand experience with heat conduction!

Some solids, such as metals, are good heat conductors, while others, such as wood, are poor conductors. Air and water are relatively poor conductors and thus are called **insulators**. Not surprisingly, many pots and pans have insulated handles.

2. Develop a plan:

On the large paper provided to you, come up with a plan to heat both of your cups of hot chocolate. Once you have a plan you believe will work, draw a diagram of what you would do. *Your diagram should include the following:*

- The material you plan on using
- Why you chose that material
- Why you did not choose the other materials
- Explain what you expect to see happen
- USE VOCABULARY WORDS IN YOUR ANSWER!



Option 1 (As stated above, this option had less scaffolding provided.)

Name: _____ Period: _____		
	Points Possible	Points Earned
Identified materials to be used	5	
Explained why the materials were chosen	5	
Identified why at least 1 other material was not used	2	
Explained the expected outcome	3	
Included vocabulary terms in explanation: Heat Thermal Energy Temperature Conduction Insulator Conductor Specific Heat	7	
Completed Diagram	3	
Total Points	25	



Option 2 (This option provided students with more scaffolding along with guiding questions. This provided students a more substantial outline to follow and allowed them to organize their thinking.)

Name: _____ Period: _____

Hot Chocolate Lab

Materials Used:

- _____ because _____
- _____ because _____
- _____ because _____
- _____ because _____
- _____ because _____

Materials Not Used:

- _____
- _____
- _____

In your set up, heat is transferred through _____.

Conduction is the transfer of energy from _____

to _____ when the objects are _____.

Describe how your set-up would work:

What happens to the thermal energy of the hot chocolate in your set up as heat is transferred?



Teaching Learning Succeeding

What eventually happens to the temperature of the hot chocolate when thermal energy is increased?

Draw your diagram below.