How Does Energy Drive the World?

Lesson Topic
Earth: Behind the Scenes, Heat Transfer

RIEL Biology Element
Multiple Modalities

Time Required
One to two class periods

Standards Addressed
- SC.912.P.10.1 Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.

Science and Engineering Practice
- Developing and using models

Content Learning Objectives
- Students will be able to model how heat energy is transferred after a series of demonstrations.
- Students will be using a gallery walk of their first draft to revise their models and adjust misconceptions from original models.

Lesson Summary

Students will observe three mechanisms of energy transfer (convection, conduction, and radiation) and then draw a model of each energy transfer. Students will use a gallery walk to peer review, and revise models that represent their responses to the guiding question: How is energy being transferred?

This lesson includes a variety of ways to represent the science content of energy transfer. The goal is to present the content in an interactive way that has students using models from their observations. Many students have a familiarity with the content and this lab is to check for misconceptions and to have students develop models using arrows to represent energy flow. The science content will be presented using demonstrations, model drawings, videos, and peer review with revisions. At each step in the lesson discussion can be used to uncover misconceptions and to promote scientific discussion among students and the class.

The lesson will have students engaging with the science content through first-hand lab experience of the types of heat energy transfer. The demonstrations provide students with shared experiences that can be referenced throughout the course. The demonstrations allow for the abstract idea of energy movement to be seen and felt by students through lived experiences.
In addition, students will be asked to draw their understanding of each energy transfer. Students will first take observations on the three different demonstrations and then draw their model of each. Arrows will be used in the models to represent the movement of energy. Students will have an opportunity to view other student work and discuss. This discussion will provide students the opportunity to revise their models and work through misconceptions.

The combination of demonstrations, drawing, videos, and discussion gives students a fuller experience of the heat energy transfer concept. Having multiple modalities to interact with the concepts will allow students to use the science vocabulary more and provide more opportunities for students to ask questions.

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Lesson Summary continued

The lesson begins with observation of models and recording information from models. Students are then asked to develop their own model of heat energy transfer in each scenario. When students first begin, they may not have the vocabulary words (conduction, convection, and radiation) to use to describe the stations, but they still can develop a model by drawing what they see and using arrows to indicate energy flow.

As the lesson progresses students will have opportunities to view other student models and analyze the models as they gallery walk the class products. Students will use "Glows" and "Whoas" to indicate things they liked about other models and questions they still have. Students then return to their model and use their peer feedback to revise their models.

Students are developing and using models from the beginning to the end of the lesson. Students are working from real world observations to create their models and through peer review could revise their models.

Materials

- Transfer of Energy Demonstration: Modeling 3 Types of Heat Transfer
- Transfer of Energy Student Handout
- Video alternatives for demonstrations –
    - Conduction
    - Convection
    - Radiation and Heat Transfer
- Three beakers
- Two metals spoons
- Ice cubes (about a cup of ice for each setup)
- Bag of white rice
- Food coloring
- Heat lamp

Teacher Notes

Videos can be used as reinforcement to the concepts. They can provide an additional opportunity to see and hear the science content. They can be used as alternatives to lab demonstrations if equipment is unavailable. It is important to note that having students do the demonstrations and watch the videos would provide more opportunities to interact with the content.

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Before the Activity

Teacher sets up 3 stations (can duplicate stations if needed):

1. Conduction:
    a. Warm Beaker: Place a beaker of water on a hot plate (lowest setting) and place a metal spoon in it
    b. Cool Beaker: Place out a beaker of cold water (can use ice cubes to exaggerate temperatures) and place a spoon in it.
2. Convection: Bring a beaker of water with ample amounts of rice and food coloring in it to a rolling boil.
3. Radiation: Take all students outside and feel the heat or if it is raining ask them to stand next to a lamp.

Lesson Activities

1. **Take students outside** and feel the heat, or if it is raining ask them to stand next to a lamp.
2. **Access prior knowledge.**
    Teacher: Ask students to create initial models of how they think energy is transferred in scenarios of their choice individually on their Transfer of Energy Student Handout.
    Student: Students consider ideas they have about how energy transfers in different scenarios that they experience and draw a model of how they believe energy is transferred in these systems on their notetaker.
3. **Teacher assigns students into groups** of 2-4 students and explains that they will eventually draw each model of how energy moves (5 mins).
4. **Teacher facilitates each group** moving through each station (3 mins each). Teacher gives each group a sheet of chart paper and different color markers.

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Lesson Activities continued

5. **Creating Models**.

   Teacher: Ask students to draw how the heat is moving through the system using arrows (20 mins).

   Students: Work in their groups to move from station to station creating their models. Make sure the arrows show how the heat/energy moves through each system.

6. **Teacher is circulating and asking probing questions** as students work on creating their models.

7. **Critique.**

   Teacher: Give students different color sticky notes to record their "glows and whoas" (5 mins).

   1. *Glows* are things they like about other groups' models; *whoas* are things they may still have questions about.

   Students: Look at other groups' models and record glows and whoas on the different colored sticky notes.

8. **Revise.** Once students have critiqued other students' models, ask them to go back to their original model. Students will revise their models based on the peer feedback they have received through the critique (10 mins).

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Name: _____ Date:_____

Transfer of Energy Student Handout: Part 1

Using a scenario of your choice, create a model of how you think energy is transferred.

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Name: _____ Date:_____

Transfer of Energy Student Handout: Part 2

STATION 1. _____	STATION 2. _____	STATION 3. _____

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