Classroom Teacher Preparation

Scientific Practices 21: The Nature of Science

Please use the following to prepare for the next SfS lesson.

Description:

This mini-lesson consists of a fun pair of geometric puzzles. The first is relatively easy and quick; the second, which builds on the first, is more challenging. Together they are a metaphor for the practice of science: various sets of data are combined to form a coherent scientific theory, but when new data is found it may require scientists to revise theories and reevaluate their previous ideas about the connections between the data.

Lesson Objectives – SWBAT ("Students Will Be Able To…"):

3rd-8th

- Assemble a puzzle of irregular pieces to form a square, and compare this to the process of constructing a scientific explanation from a variety of sets of data
- Assess the relative difficulty of the original puzzle to the task of adding a new piece to the puzzle, and re-forming a square; compare this to the challenge of adapting a scientific theory to new ideas

Disciplinary Core Idea (DCI)

ETS1 Engineering Design - ETS1.C Optimizing the Design Solution

- (3rd-5th) Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints
- (6th-8th) The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution

Science & Engineering Practice (SEP)

Constructing Explanations and Designing Solutions

- (3rd-5th) Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem

Engaging in Argument from Evidence

- (6th-8th) Evaluate competing design solutions based on jointly developed and agreed-upon design criteria

Crosscutting Concept (CCC)

Systems and System Models

- (3rd-5th) A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot
- (6th-8th) Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems

Preparation:

This mini-lesson is intended for use as the second half of a first-day visit. No preparation by students is needed.

Room Set Up for Activities:

Students will work individually, at their desks.

Safety:

There are no safety concerns with this lesson.

Related Modules:

This lesson may be taught as part of a sequence or group of related modules on **Scientific Practices**. Modules include:

Scientific Practices 2: Observation Challenge – Students classify objects based on their observations, and learn how different classification schemes influence their view of the objects/world.

Scientific Practices 3: Mystery Tubes – Focuses on the importance of models in science. Students observe a "mystery tube" and then build models to understand how it works.

Scientific Practices 8: Experimental Design – Using a ruler drop procedure (testing reaction time) as a starting point, students will develop a testable hypothesis and design an experiment around it.

Scientific Practices 22: Team Building Mini Lesson - Cup Stacking – Promotes team building through cup stacking (with limited tools and restricted communication). Developing good teamwork skills at the beginning of the year will prepare students for the active group work they will be involved in throughout the year in their science classes.

For other module sequences and groups, look here: www.sciencefromscientists.org/sequences

Standards Covered:

Please click the following link to our website to review the standards covered by this lesson, listed by state: www.sciencefromscientists.org/standards/

Lessons are matched to both national NGSS and local state standards.

After Our Visit:

Extend this lesson by encouraging students to research the history of science for additional examples of changes in scientific thought. "Revolutionary ideas in science" and "history of scientific ideas" are good search terms to start with.

Access this Extension activity by visiting the Classroom Post found on our website at sciencefromscientists.org/cohorts. Use the name of your school/cohort and password to log in.

To help Evaluate, check out our Open Response questions online at sciencefromscientists.org/open-response-questions. They are freely available for all of our lessons for current teachers. Use the password supplied by your instructor to log in.

Additional Resources:

- For students who want more of this type of spatial-reasoning puzzle, this website will be fun: http://brainden.com/geometry-puzzles.htm
- More, in a different style, probably for older students: https://mathwithbaddrawings.com/2018/10/03/twenty-questions-of-maddening-delicious-geometry/