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Project-Based Inquiry Science™ Case Study
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Learning Set 1

Learning Set 1 Additional Content Support

Exploring the Science Framework
The National Research Council's recent publication, A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas, places unprecedented focus on the practices involved in doing scientific and engineering work. In an effort to lend specificity to the broad notion of "inquiry," the intent behind the practices outlined in the Framework is for students to engage in sensible versions of the actual cognitive, social, and material work that scientists do. This article focuses on one of those practices: "obtaining, evaluating, and communicating information" and provides detailed examples of implementation for pre-K, grades 5, 8, and 10.

Engaging Students in the Scientific Practices of Explanation and Argumentation
This article examines two of the eight science and engineering practices, concerning explanation and argumentation. The two practices depend on each other: For students to practice explanation construction, they must also engage in argumentation. Argumentation and explanation are first defined individually and then their relationship is explored in four classroom examples.

The Scientific Method
A common misconception in science is that science provides facts or "truth" about a subject. Science is not collection of facts; rather, it is a process of investigation into the natural world and the knowledge generated through that process.

Density
Density is a fundamental physical property of matter. This module introduces the concept of density, explains how density is calculated, and lists the densities of common substances. The relationship between density and buoyancy is discussed. The module relates the concept of density to the operation of large ships, submarines, and hot air balloons.

Buoyancy Basics
This site goes over the basics of buoyancy using an example of wood blocks in a cup of water.

What is Matter?
This video/animation defines matter, mass, and volume using water as an example. The size, electrical charge, and location of the subatomic particles of matter are described.

Learning Set 2

Learning Set 3
As you saw, Digging In is a PBIS Launcher Unit. Do not expect mastery of the science concepts in this unit. To help you understand the pacing issues in PBIS units, select "PD Videos" and view Pacing in a PBIS Classroom to see how other teachers have handled pacing. Consider how you will deal with pacing in your classroom.

Duplicate the Parent Letter on the Unit Home Page to send home with the students on the day you begin the unit.

**Unit Overview, What's the Big Question? The Build a Boat Challenge, and 1.1 Identify Criteria and Constraints**

Read The Storyline and Science Content and view the Digging In Walkthrough Video, What's the Big Question?

Read the Student Edition What's the Big Question, and read the Overview of What's the Big Question?

Read the page-specific teaching notes for What's the Big Question? One teacher suggested that a Teacher Talk question you could ask students is "How many scientists do we have in class today?"

Read the page-specific teaching notes for The Build a Boat Challenge DIG 4-5 Teaching Strategies, Meta Note, and Teacher Talk.

Read the Section Planning Guide Materials and page-specific teaching notes for 1.1 Identify Criteria and Constraints.

View the Walkthrough Video for 1.1.

View the Equipment Set-up Video for Section 1.1. Gather the equipment that you will need. Consider whether you will provide each group with water to test their boat (this is the ideal situation) or whether you will have one station at which students can test their boats.

Build and test a boat to carry the keys before class.

In the CyberPD Journal, make any additional notes that you will find helpful in the classroom. You can do this by clicking on the pencil icon.

Duplicate the Boat Records page.
“Just-in-Time” Support

Page 9

1.2: Build a Better Boat I

- Walkthrough Videos (1)
  - Section 1.2
- Equipment Setup Videos (1)
  - Section 1.2
- Correlations (2)
- Section Preparation Materials (8)
  - Overview
  - Activity Setup and Preparation
  - Meeting the Needs of All Students
  - Targeted Concepts, Skills, and Science Practices
  - Purpose and Assessment Guide
  - Materials
  - Boat Records BLM
  - Solution-Briefing Notes BLM

Build a Better Boat I

Plan Your Boat Design
You built your first boat quickly and without much planning. It may or may not have worked well. During this second attempt, you have a chance to design and build a boat that really works. Consider what you learned from your first attempt. Did it meet the criteria of the challenge? If not, what can you do to improve the design so it meets the criteria? You may get ideas by thinking about the different designs that your classmates came up with. Think about the designs that worked well and those that did not. Discuss these ideas with your group members. This will make your design better.

Build a Better Boat I

When people design things, they usually call it a product. Often, engineers do not create the best or most successful product the first time. Just like you did with your group, they try something. Then they figure out the strengths (what was good) and the weaknesses (what was not good) in the design. They might decide that they need different materials. They might decide that they need to put things together differently. They might decide to make small changes or to make big changes. After the first time, they understand the challenge better. After the second time, they may also find that their solution is not as good as they would like. Engineers often try again and again before they get the product just the way they want it. Each try is called an iteration.
Meta Note

Remember that a challenge serves to anchor targeted concepts and skills, while giving students a reason for asking questions and a context for applying what they are learning. The Build a Boat Challenge will help students focus on the value of collaboration and iteration, and how science knowledge can help in solving everyday problems.
Day 11 - 12
3.2 What Causes Erosion?
DIG 53-66
To better understand the effects of erosion, students read various case studies showing them real-life examples of how this problem has been solved.

View the Walkthrough video for Section 3.2.

Read Section 3.2 in the student edition, DIG 53-66.

Read the Section Preparation Guide Materials.

Duplicate the Erosion Case Study page, four per student.

Read the page-specific teaching notes.

Read the Sample Answers for Erosion Case Study pages provided.

If you wish, edit and duplicate the Additional Homework Option questions for Section 3.2.

After completing Section 3.2, consider the Teacher Reflection Questions. In your CyberPD Journal, make notes that will help you when you teach this section again.

Day 13 - 14
3.3 Investigating Factors that Affect Erosion
DIG 67-75
The class is divided in half to run two simultaneous investigations. To share the results, students participate in their first Investigation Expo.

View the Walkthrough video for Section 3.3.

Read Section 3.3 in the student edition, DIG 47-52.

Read the Section Planning Guide Materials for Section 3.3. See the Equipment Set-Up video for Section 3.3 (in development).

Duplicate the Particle Size and Erosion and Slope and Erosion pages, one for each student—half of the class will do one investigation and half will do the other investigation.
Reflection
3.3 Investigate

**Investigating Factors that Affect Erosion**

On your erosion walk and while you were reading, have you noticed that the type of soil or other Earth surface features influence how and when erosion occurs? Investigate several different types of soil and materials and discuss how you can reduce soil and gravity affect their erosion.

Your class will complete two investigations. One investigation will help you investigate the relationship between particle size. Each group will collect and sort the different soils to determine the size of the soil and how it affects the soil. You can then conclude the activity with the findings of the class. In this way, you will compare how one group came to this one another.

**Variables and Designing Experiments**

When you investigate a phenomenon, you will want to test how many factors affect the phenomenon. For example, it is often useful to have a control group that is the same as the experimental group except for the independent variable. The point of most experiments is to understand the phenomenon you are investigating. The independent variable is the phenomenon you are investigating. The independent variable in this case is soil size since the other factors are the same. Soil size is a factor that can have many different values, and it is a factor that must be changed to answer the question: **“What is the Relationship Between Particle Size and Erosion?”**

**Investigation 1: What Is the Relationship Between Particle Size and Erosion?**

You saw in the case studies that water is a very powerful agent of erosion. Many of the examples of erosion you saw on your erosion walk were probably caused by water. As water runs over Earth’s surface, it picks up and carries away particles of soil and other materials. Some particles...
3.4: Create an Explanation

Communicate
Share Your Explanation
When everyone is finished, you will share your explanations with the class. As each group shares theirs, record the explanation. You might also create a poster for the classroom that has the full set of explanations on it. You will have an opportunity to review your explanations after you learn more about what causes erosion and how it can be managed.

What's the Point?
Science is about understanding the world around you. Scientists gain understanding by investigating and explaining. The results of investigations are useful in making sense of and organizing the world. To help others better understand what they have learned through their investigations, scientists must communicate their results and understandings effectively.

Scientists make claims about the phenomena they investigate. They support their claims with evidence they gather during investigations. They also review science that others have written about. They combine all of that together to create explanations of their claims—statements about why their claims are so. Other scientists carefully examine these explanations. They discuss them with each other. They try to decide if the explanation is complete enough for them to be sure about whether the claim is valid. Scientists accept a claim as valid when many different scientists agree. The evidence and their science knowledge must justify the claim. Scientists also help each other make their claims and explanations better.

Throughout this school year, you will investigate a variety of phenomena. You will apply what you learn to solving Big Challenges and answering Big Questions. You will be asked to create explanations. Every explanation you write will include a claim, evidence, and science knowledge. As you move through each Unit and learn more, you will create new explanations. You will have the opportunity to edit and improve the explanations you created earlier. Just as you iteratively improved your boats, you will iteratively improve your explanations.

You will also use explanations you create to help you predict what will happen in new situations. For example, now you know that rain, waves, gravity, and wind are all causes of erosion. That means you can probably predict what might cause erosion around the proposed basketball court. Make sure you can make that prediction. Making that prediction successfully will help you know that you understand the science you have been learning.

What difficulties did students have understanding what a scientific explanation is? What ideas do you have for guiding their understanding during the next section?

Would modeling another explanation be beneficial for the students? What ideas do you have for modeling explanations?

How did you use the student text? How could you assist students in their reading ability as well as their comprehension?
Welcome to the Getting Started PBI Science CyberPD Course for Animals in Action. My name is Jean Pennycook and I will be the facilitator for the course. We hope these assignments will introduce you to the online PD tools for Animals in Action and support your instructional practices and use of the curriculum materials.

We recommend you complete the course before you begin instruction. We hope after completing these assignments you will be familiar with the teacher-support assets on the CyberPD website and continue to use them as throughout your instruction of this...
Animals in Action Assignment #1

Getting to know Edmodo and your Professional Learning Community

Introduce yourself to the Group by hitting the Reply button here and post a little bit about yourself. For example: How many years have you been teaching? What is your current teaching assignment? How familiar are you with project-based and inquiry learning?

3 Replies

Ms. Bauer • Jul 21, 2014

Hi everyone! I will be starting my 20th year of teaching this fall. My 16th at ELMS (yikes!) I am currently the science team leader in my building and a 7th grade teacher. I have an idea about what PBI learning is and I am anxious to see how it looks with PBI science.

Mrs. Belsky • Jul 23, 2014

Hi! I'm Stacey Belsky and will be starting my 10th year of teaching at ELMS. I taught 6th grade for the first 8 years then switched to 7th last year where I will be again this fall. I am not very familiar are you with project-based and inquiry learning but am sure that will soon change!

Ms. Pennycook • Jul 24, 2014

Stacey,
Thank you for joining the class. Let me know if you have any questions.
Jean