Pop Rocks, Soda, and the Scientific Process

STEM: Science, Technology, Engineering, Mathematics

STEM Classroom Series

The STEM Classroom Series features lessons that promote understanding of STEM content knowledge, integrate STEM with non-STEM subjects, and increase students' exposure to STEM-related career options.

About This Segment

At Sandstone Elementary in St. George, Utah, science teacher Ms. Cindy Hatch guides a 1st grade class to explore the scientific process through an activity involving soda and pop rocks.

Application activities (complete all that meet your goals for viewing this segment)

A. Learn more about STEM education

1. In the table on the next page, identify the elements of effective instruction, as well as the elements of effective STEM instruction, that you observed in this lesson.

2. How could the teachers enhance or add to the elements of instruction in their lesson?

3. How could the teachers enhance or add to the elements of STEM instruction?

C. Infuse STEM principles into your own lessons

1. Apply the six questions in the "Replicate this lesson" activity to one of your own lessons.

2. Determine challenges you might face in applying these STEM concepts to your own lesson. How can you overcome these challenges?

B. Replicate this lesson

1. *What are the learning objectives you want your students to achieve?*
   How would you modify the lesson's objectives, outlined in the lesson plan below, for your own students and curriculum? What other objectives, if any, will you set?

2. *What content knowledge do you need to acquire or expand?*
   This activity is based on age-appropriate steps of the scientific process. For resources that will help you review the process, visit the Resources to Support Content Knowledge links in the Resources section of the lesson plan.

3. *How will you create the time and space to engage students in this lesson?*
   How much time will this learning activity take to plan and carry out? How can you integrate the activity into your current curriculum map?

4. *What materials and other resources do you need for this lesson?*
   What resources are needed for this lesson, including collaboration with other teachers and with administrators? See the Resources section of the lesson plan.

5. *How will you assess student learning?*
   In this lesson, students completed an activity sheet. (See end of lesson plan for a copy.) How will you assess and provide feedback using this sheet and other evidence from the class?

6. *How can you promote a STEM focus in your instruction?*
   What STEM experiences were students engaged in during this lesson? (See the "Elements of Effective STEM Instruction" below.) What are some others that you could include?

Elements of Effective Instruction	Elements of Effective STEM Instruction
- High expectations for all students - Rigorous content - Authentic performance tasks - Real-time assessment adapted to student needs - Student-driven learning - Strong relationships among students and between teacher and students - Equitable, culturally relevant content and practices - Evidence of 21st century skills, e.g. critical thinking, problem solving, collaboration, creativity, communication - Technology that enhances learning - Cross-curricular (interdisciplinary) integration	*In addition to the Elements of Effective Instruction left, effective STEM instruction can include:* - Teachers who develop solid STEM-related content knowledge - Hands-on problem-solving activities that have real-world relevance - Integration of STEM into non-STEM subjects, especially art and design - Use of industry-standard software, tools, and procedures such as the engineering design cycle - Increased awareness of STEM fields and occupations, especially among underrepresented populations - Enthusiasm about further STEM-related learning - Connections between in-school and out-of-school learning opportunities - Industry and higher-ed partnerships that encourage hands-on student exploration of STEM-related careers

Sources: California Dept. of Education. (2015). Science, technology, engineering, & mathematics. Retrieved February 21st, 2015, from http://www.cde.ca.gov/pd/ca/sc/stemintrod.asp

President's Council of Advisors on Science and Technology (PCAST). (2010). Prepare and inspire: K-12 education in science, technology, engineering, and math (STEM) for America's future. Retrieved from the Whitehouse.gov website: http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-stemed-report.pdf

General STEM Information and Resources

Utah STEM Action Center (n.d.). STEM Utah. Retrieved January 22, 2015, from http://stem.utah.gov/

California Department of Education (n.d.). Science, technology, engineering, and mathematics. Retrieved January 22, 2015, from http://www.cde.ca.gov/pd/ca/sc/stemintrod.asp

National Education Association. (n.d.). The 10 best STEM resources: Science, technology, engineering & mathematics resources for preK-12. Retrieved March 23, 2015, from http://www.pbs.org/teachers/stem/

National Research Council. (2011). Successful K-12 STEM Education: Identifying Effective Approaches in Science, Technology, Engineering, and Mathematics. Retrieved March 23, 2015, from http://www.stemreports.com/wp-content/uploads/2011/06/NRC_STEM_2.pdf

PBS Teachers. (n.d.). STEM education resource center. Retrieved March 23, 2015, from http://www.pbs.org/teachers/stem/

STEM Education Coalition (n.d.). Home page. Retrieved January 22, 2015, from http://www.stemedcoalition.org/

Pop Rocks, Soda, and the Scientific Process — Lesson Plan

Teacher: Cindy Hatch	**Grade/Content Area**: 1st Science
School: Sandstone Elementary, St. George, Utah	**Lesson Duration**: 50 min.

Lesson Objective(s)

Students will go through the steps of the scientific process as the teacher models an experiment to see which bottle of soda inflates a balloon the most when Pop Rock candy is added to the soda. Each student will make a hypothesis, test their hypothesis, record their observations, and draw a conclusion based on their observations.

Key Concepts and Vocabulary

(See below for online resources that support content knowledge)

- Hypothesis, observation, conclusion
- Gas, carbon dioxide

Standards

Students will be able to apply scientific processes and communicate their ideas effectively.

Assessment

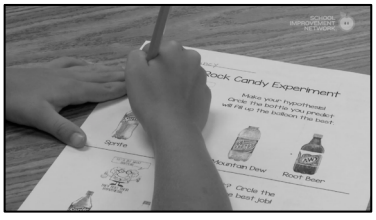
The teacher will lead students in a discussion and experiment modeling the scientific process. Students will partner-share and record their hypotheses, observations, and conclusions regarding the experiment. Their recordings must be completed as their "ticket" out the door.

Prior Knowledge

Students are familiar with the scientific process and have previously completed a similar experiment where vinegar and baking soda were used instead of soda and Pop Rocks candy.

Materials

- Eight packages of Pop Rocks candy: four for the experiment, and four to give students beforehand to ensure they know what Pop Rocks are
- Four 12-16 oz. sodas in different flavors (root beer, Sprite, Coca-Cola, and Mountain Dew used in this lesson)
- Four balloons and funnel (funnel needed to pour one package of Pop Rocks in each balloon)
- Recording sheet for the scientific process
- Reference sheets for scientific process steps
- SMART Board or whiteboard to record and model hypotheses, observations, conclusion, etc.



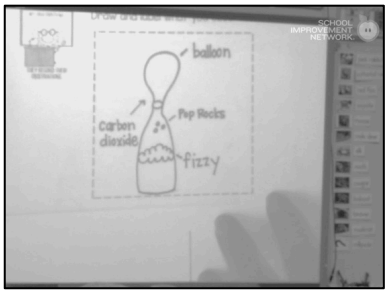
Lesson continues on the following page.

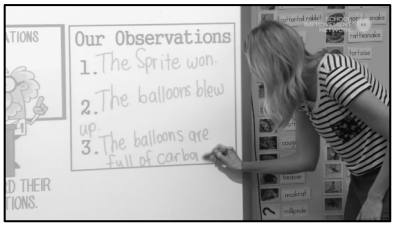
Activity Plan

Activator: The teacher will make reference to the vinegar and baking soda experiment previously taught. The teacher will give each student a small amount of Pop Rock candy to eat and ask what will happen if we add Pop Rocks to different types of soda. Which type of soda will cause the balloon to blow up the most?

Whole-Class Activity: The teacher will lead a discussion modeling the scientific process. Students will make a hypothesis with a partner and then record it on their sheet. Students will observe the experiment, discuss it with their partner, and record their observations. Finally, students will discuss their conclusion with their partner and record it.

Discuss the Science in the Experiment: Just as the vinegar and baking soda make carbon dioxide when mixed together, Pop Rocks have tiny carbon dioxide bubbles inside each rock. These bubbles make the popping sound you hear when they escape from their candy shells. The carbon dioxide inside in the candy isn't enough to make the balloon inflate. It needs the soda to help it do that. The soda also has pressurized carbon dioxide gas (it's called a carbonated beverage). When the Pop Rocks are dropped into the soda, some carbon dioxide is able to escape from the sugar in the soda, and because the carbon dioxide gas has nowhere to go in the bottle, it gets trapped in the balloon and inflates it.





Differentiation

The teacher will check for understanding, assisting when necessary during partner sharing and when students use their recording sheets. Students may record their observations and conclusions by drawing pictures only, drawing and labeling, or drawing and writing sentences describing their findings.

Resources to Support Content Knowledge

123 Homeschool 4 Me. (n.d.) Pop rock science experiment for kids. Retrieved September 15, 2015, from http://www.123homeschool4me.com/2015/03/pop-rock-science-experiment-for-kids.html

Pop rocks expander - candy science. (n.d.) Retrieved September 15, 2015, from https://www.stevespanglerscience.com/lab/experiments/poprocks/

Science buddies. (n.d.). Steps of the scientific method. Retrieved November 11, 2015, from http://www.sciencebuddies.org/science-fair-projects/project_scientific_method.shtml

Related Video Lessons and Resources

5th grade STEM: Exploring circuits. Edivate. https://www.pd360.com/index.html - resources/videos/10418

5th Grade STEM: Making maglev cars with the engineering design process. Edivate. https://www.pd360.com/index.html - resources/videos/8695

Name_____

Pop Rock Candy Experiment

Make your hypothesis!
Circle the bottle you predict
will fill up the balloon the best.

Sprite

Coke

Mountain Dew

Root Beer

Were you right? Circle the
soda that did the best job!

Sprite

Coke

Mountain Dew

Root Beer

Draw and label what you observed.

THEY RECORD THEIR OBSERVATIONS.

Write the name of the soda you conclude is the best at blowing up a balloon.

THEY COME TO A CONCLUSION.