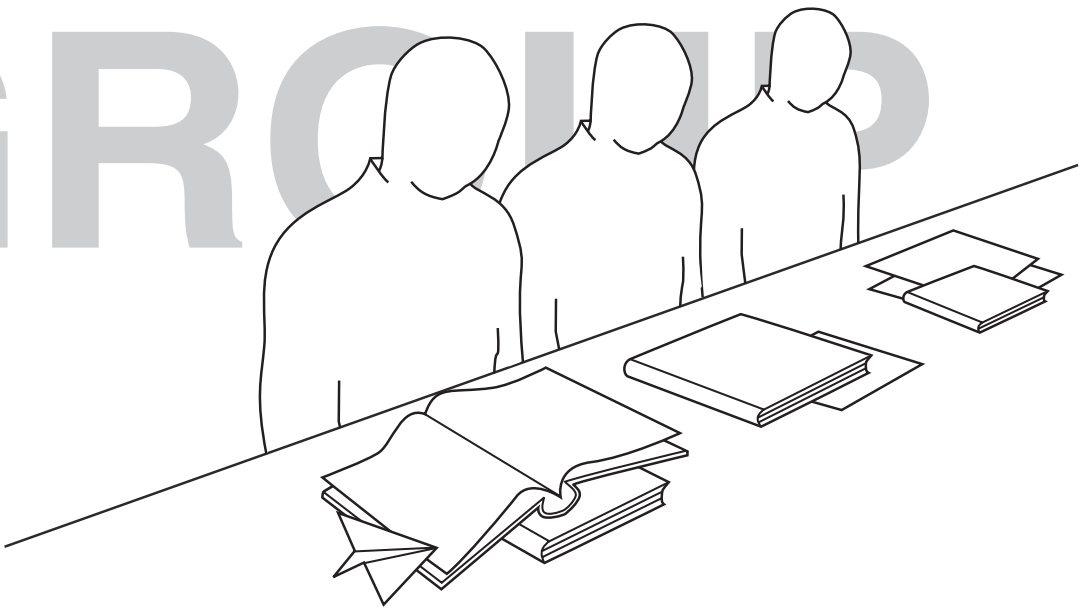
learning lab

BLUE MAN GROUP



The Science of Goo

Mysterious Substances

GRADES 3–5

THE BLUE MAN CONNECTION

The heart of a scientist beats within the Blue Man. Whether by experimenting with PVC pipe and sound, or by taking us through the inner workings of eyes and brains, the Blue Man is front and center curiously investigating life and its mysteries. This lesson will present students with unknown substances that they will be asked to analyze in an effort to build skills of scientific inquiry and problem solving, thereby cultivating the potential scientists that may be waiting within their minds and on the tips of their fingers.

LESSON SUMMARY

Before students enter the room, prepare 15 bowls of easily obtained, common, and cheap substances. These substances could be jelly, marshmallows, rice, seeds, Jell-O, potting soil, gravel, feathers, marbles, cotton, mayonnaise, cookie dough, Vaseline, leaves, and tinsel, for example. A variety of substances should be included to provide students a wide-ranging tactile experience. Arrange bowls in sets of three.

Begin the lesson by choosing one bowl and modeling how you might find out the given properties of the substance in the bowl. Possibly ask questions like, What color is it? Is it hard or soft, heavy or light, prickly or smooth, wet or dry, sticky or slippery? Does it crunch or crinkle when you move it around? Does it slip through your fingers? Does it smell? Brainstorm other possible questions with students. Draw students' attention to the fact that scientific experimentation often starts with observing things and asking basic questions. If applicable to age and local curricular needs, remind students of a science basic: Substances have physical and chemical properties that can be used to categorize and understand the substance. Physical properties, the properties on which this lesson focuses, include color, smell, opacity, viscosity, and density.

Once the lesson has been introduced, break students into groups of 3 or 4 and assign each group to a table of grouped bowls. (Bowls should be grouped in interesting and not necessarily logical or typical combinations. More interesting combinations of substances will require students to stretch a bit to make connections.) After students have been successfully grouped, and found their bowl grouping, tell students that each group will need to do the following: 1. Touch the substance in each bowl, 2. Use the questions that were brainstormed, and possibly others they have thought of since the introduction, to investigate the substances, and 3. Describe each substance on paper. (Write three descriptive sentences/statements about each substance. One paper per group.) If the substance is easily identified, encourage students to think beyond the obvious name/classification, looking closely and carefully at the particular properties of the substance that they may not have previously noticed in earlier experiences with the substance.

Allow students 15-20 minutes to explore the substances at their tables, writing descriptive sentences for each substance. Remind students to be mindful of one another while they are looking at the substances—take turns, be courteous of others at the table, and be good listeners. Following their investigations, each group will share their descriptions with the larger group. Allow 15 minutes for the group to share their descriptive sentences.

After group discussion, students take 10 minutes to individually respond to the following questions on small sheet of paper: 1. Describe the process of investigating each substance. (How did you think of ways to describe each substance? Did you think of ways the separate substances were alike or different from one another? Was it easier by the time you investigated the third substance?) 2. What did you notice about working in groups? (Was it easy to talk about each substance as you went along? Was it helpful to have other scientists involved? Did you learn anything through talking with fellow scientists as you worked?) 3. How can this process be used in your day-to-day life? (When can you use the skill of observation? Where have you seen a similar process—observing things carefully and thoroughly—being used? Who are particularly good observers, and why?) Give students the opportunity to share their answers to their individual questions during the last few minutes of the lesson.

CONNECTING TO NATIONAL STANDARDS

Science- NS.K-4.1 Science as inquiry, NS.K-4.2 Physical science—Properties of objects and materials

English/Language Arts- NL-ENG.K-12.5 Communication strategies, NL-ENG.K-12.7 Evaluating data

Making Goo

GRADES 6–8

THE BLUE MAN CONNECTION

The Blue Man is not afraid to get messy in the pursuit of knowledge and fun. Paint soars. Twinkies smoosh. Marshmallows fly. A Blue Man's drive to concoct, disturb, agitate, and invent provides fuel to the creative fire. This lesson seeks to allow students to step into scientists' shoes. Students will create goo and investigate its properties in great depth as they learn to see with clear eyes, ask thoughtful questions, and describe what they see in careful detail.

LESSON SUMMARY

You may want to model making goo in a previous class. You will need the following materials: 1. 1 ½ cup of corn starch per group, 2. Medium Ziploc bag for each group, 3. Plastic container for each group, 4. Measuring cup for each group, 5. ¾ cup of water for each group; and 6. Food coloring for each group. Have materials placed on tables/desks in a way that facilitates an easy transition to the activity.

Time will be tight, so allow only 10 minutes for groups to form and goo making to commence. Divide students into groups of 3-4. Ask students to mix 1 ½ cup corn starch with ¾ cup of water. This process should take 15 minutes or less. Each group should have enough goo for each student to take a small portion to work with and explore. Once the groups have made their piles of goo, encourage students to investigate the substance. (Students may want to mix food coloring into the goo at this point and observe what happens as the food coloring disperses throughout the goo.)

Ask groups to take 15 minutes to record observations of the goo on group experiment logs. What texture does it have? What shape does it have? What color is it? Does it stretch? Does it bounce? Does it float? Encourage students to ask questions and make as many observations as time will allow. Also remind them of the need to respect all ideas and space, and to listen to one another.

Take 15 minutes and ask groups to share their observation logs with the class. What were consistent properties of the goo? Did any groups find unusual properties? Were there any differences? Why might those differences have existed? What was it like to work in a team during this process? In what ways did collaboration help or hinder the scientific process?

Allow 10 minutes for cleanup.

CONNECTING TO NATIONAL STANDARDS

Science, NS.5-8.1 Science as inquiry, NS.5-8.2 Physical science

English/Language Arts, NL-ENG.K-12.5 Communication strategies, NL-ENG.K-12.7 Evaluating data

The Failure of Goo

GRADES 9–12

THE BLUE MAN CONNECTION

The Blue Man scientist enters an investigation of gooey things with a thirst for knowledge and a curiosity that blurs the line between work and play. His questions are big. His mind is sharp. If necessity is the mother of invention, then the Blue Man scientist focuses his attention on what the world needs and uses science to solve the problem. Silly Putty, Teflon, and Post-it Notes are examples of gooey products that aspired to meet specific needs and were developed from experiments gone awry. These substances were created and eventually put to uses for which they were not originally imagined. Out of experimental failure came innovation and success—victory was snatched from the jaws of defeat. This lesson seeks to give students the opportunity to step into the shoes of the pioneers of goo—as scientists on the cutting edge of goo development—and learn from perceived experimental failure.

LESSON SUMMARY

Introduce the lesson by sharing the story of the famous gooey substances Silly Putty (discovered in pursuit of a creating an alternative to rubber), Post-It Notes (discovered in pursuit of stronger adhesive), and Teflon (discovered in pursuit of stronger metal). Explain that their stories represent scientific experimentation at its best—innovation through supposed failure. Take 10 minutes to introduce these examples and brainstorm other possible examples they might know of where failure was not really failure in science.

Break the class into groups of 3-5 students. Tell them they are scientists working for very important scientific laboratories. Each group has been asked to create a goo-related substance. They will be asked to present a report to the board of directors of their lab in which they explain 5 principal facts: 1. What is the name of the substance they sought to create? 2. What is the intended purpose of the substance? 3. What were the observations they collected during the experiment? (What were the basic properties of their substance? Did their substance possess the necessary strength, keep a shape, bounce high enough, or stretch far enough?) 4. Why don't the properties of the newly created substance meet the original experimental objective? 5. What is the purpose and use of the new substance? (Provide 3 ways in which it meets a newly defined need.) Students should be given 20 minutes to draft their report.

Students should then be given 5 minutes per group to present their reports to the board (the classmates and teacher). If students have access to the technology, reports could be created and presented in PowerPoint. Though that is not a necessity. This portion of the exercise should take 20 minutes, depending on the number of groups. Students should be reminded that being respectful listeners, and sensitive audience members is central to this project being successfully shared.

End the lesson with a discussion of several key ideas: 1.There is value in both success and failure within the scientific process; 2. Innovation results from experimental failure as well as success; 3. Scientists find value in positive and negative experimental data and results.

CONNECTING TO NATIONAL STANDARDS

Science- NS.9-12.1 Science as inquiry, NS.9-12.2 Physical science, NS.9-12.7 History and nature of science

English/Language Arts- NL.ENG.K-12.4 Communication strategies, NL.ENG.K-12.6 Applying knowledge