

DREAM. BUILD. BECOME.

ACE METAL FOUNDATIONS

By IACMI

Silly Putty



Silly Putty



Prior Knowledge

This activity requires a basic understanding of materials and their properties. Students will need to be able to follow multi-step directions with relative independence. Students must also be able to use measuring tools with attention to accuracy and understand how to describe differences using comparative language.

Silly Putty

Lesson Overview

In this lesson, students investigate how the way a material is processed affects how it behaves. While students will use simple, familiar ingredients, the focus of the activity shifts from simply making a material to controlling the outcome of that material by carefully following, adjusting, and reflecting on each step in the process.

Students will create a flexible material by combining ingredients and applying deliberate actions such as mixing, kneading, and timing. As they work, students are encouraged to pay close attention to how changes in the process (such as how much time the material spends in a solution or how thoroughly it is mixed) affect the final result. Rather than treating changes as surprises, this lesson helps students recognize patterns and connect specific actions to predictable outcomes.

The lesson emphasizes that making materials is not just about combining ingredients, but about consistency, attention to detail, and control. Students compare batches, discuss differences, and begin to reason about why materials made from the same ingredients do not always behave the same way. This supports deeper cause-and-effect thinking and introduces students to the idea that small changes in a process can have large effects on a material's performance.

From a manufacturing perspective, this lesson reflects how real materials are made and refined. In factories and engineering settings, materials are produced in batches, tested, adjusted, and remade to ensure they behave in reliable ways.

Vocabulary

Material: The matter from which a thing is or can be made

Batch: A group or quantity of material made at the same time

Control: Keeping a step in a process the same, on purpose

Outcome: How something turns out



Figure 1: Silly putty created by mixing different materials to create a new product.

Silly Putty

The Foundations of Controlling Materials

Have you ever noticed that two things made from the same material don't always act the same way? One might stretch more, another might break more easily, even if they look alike. That's because materials don't just depend on what they're made of. They also depend on how they are made.

When people make materials, they follow a process. A process is a set of steps, and each step matters. Mixing longer or shorter, using more or less of something, or working a material differently can change how it behaves.

Today, everyone will use the same ingredients to make a material. As you work, you may notice that not every material turns out the same. That isn't a mistake; it's an important clue. Differences help us learn which steps matter the most.

Engineers and factory workers think this way every day. They compare materials, notice small differences, and adjust their processes so materials work the way they need them to. If a material is too stiff, too sticky, or too weak, they don't give up, they change how it's made and try again.

As you make and test your material today, you will practice the foundations of controlling materials: paying attention to steps, noticing changes, and thinking about how your actions affect the outcome. These are the same skills engineers use when they design and improve materials for the real world.

Materials

Materials Supplied in Kit

Per Student

- 2 tablespoons of glue
- 4 drops of food coloring (optional)
- 2 tablespoons of Borax solution (see notes in Activity Directions for creating the solution)
- 1 mixing bowl
- 1 disposable spoon
- 1 craft stick (for facilitating glue removal from measuring spoon)

Materials Supplied in Kit

Shared

- ½ gallon jug (for creating Borax solution)
- Borax container
- [5] 1 tablespoon scoops
- [5] 1 teaspoon scoops
- [5] 1/8 teaspoon scoops

Silly Putty

Activity Directions



Teacher

Step 1: Create the Borax solution

- Mix 1.5 tablespoons of Borax powder in a ½ gallon of warm water to create the “Borax solution”
- You can use a rolled up piece of paper or folder to create a makeshift funnel to facilitate pouring Borax into the opening of the jug

Students

Step 2: Combine the Materials

- Measure 2 tablespoons of glue and pour it into your bowl. Use your craft stick to help scrape remaining glue off of the measuring spoon
- Mix four drops of food coloring into the glue, using your spoon



Silly Putty

Activity Directions Continued

Step 3: Add the Borax solution

- Add 2 tablespoons of the Borax solution slowly to the glue/food coloring mixture and stir with a spoon until the glue begins to separate from the bowl

Step 4: Knead the mixture

- Once the glue has begun to separate from the bowl, knead the mixture in your hands until the putty begins to form
- If your putty is too sticky, briefly dunk the putty back into the Borax solution and continue to knead with your hands until the desired consistency is achieved
- *Note: allowing the putty to spend several minutes in the Borax solution will create a rubbery putty that no longer sticks to itself*



Discussion Prompts or Reflection

- If everyone uses the same ingredients, do you think everyone's material will turn out the same? Why or why not?
- What could happen if a step is skipped or done differently?
- How did your material turn out compared to the comparison batch?
- Why do you think it might be important to try to make materials turn out the same outcome every time?

Silly Putty

Variations and Enrichment

- Teacher-led demonstration: too few vs. too many changes
 - Create a small batch where all variables in this experiment are changed, and another small batch in which only one variable is changed. Collect student observations regarding what happens to the end-product when you slightly change the recipe, and what happens when you significantly change the recipe
- Individual variation: adjust and test
 - Create groups of students who will slightly adjust one part of their process, not their ingredients (e.g: more kneading, less mixing, etc) and observe how the process itself affects the materials
- Extension: Predict before changing
 - Before making a change, students predict how it will affect the material. Afterward, compare visible results to prediction.

Foundation Exploration

- **Materials technicians** help test and compare materials to see how they stretch, bend, or break. If a material doesn't work the way it should, they help figure out what part of the process needs to change
- **Some cooks and food developers** test recipes again and again to get textures just right: chewy, soft, stretchy, or smooth. They change amounts and timing to control how food materials behave
- **Factory workers** who run machines must carefully control how materials are mixed, heated, or formed. Small changes in a process can cause big problems if materials don't turn out the same each time.
- **Engineers** decide what a material needs to do before it is made. They help choose materials and design processes so products are safe, strong, and reliable.



Figure 2: A tensile test machine measures how much pulling force a material can withstand before it breaks



Figure 3: A hardness tester measures a material's resistance to dents, scratches, and wear.