

DREAM. BUILD. BECOME.

ACE METAL FOUNDATIONS

By IACMI

Silly Putty



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Prior Knowledge

This activity requires little prior knowledge. Students should possess basic number sense (1-4) in order to accurately count out ingredients. Students will also need the ability to perform one-to-one actions, in which an action is performed the same number of times as directed. Lastly, students will need basic fine motor coordination to adequately mix the materials.

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Lesson Overview

In this lesson, students explore how new materials are made by combining ingredients and applying specific actions to change how those materials behave. Rather than focusing on scientific vocabulary or abstract concepts, the activity emphasizes hands-on processing—mixing, adding, and kneading—to help students see that materials do not simply exist as they are; they are designed and made by people.

As students follow a step-by-step process to create a flexible material, they observe how each action affects the outcome. They compare the starting ingredients to the final product and notice that what you do to a material is just as important as what it is made from. This supports early understanding of cause-and-effect and introduces the idea that materials can be intentionally changed for a purpose.

Although the activity uses simple, classroom-safe materials, the thinking behind it mirrors real manufacturing practices. Engineers and manufacturers combine materials, control how they are processed, and test the results to determine whether a material will work for a specific job. This lesson introduces those ideas at an age-appropriate level, helping students begin to see themselves as makers and problem-solvers, not just observers.

Vocabulary

Material: What something is made of

Mix: To put things together and move them around

Change: To become different

Process: The steps you follow to make something

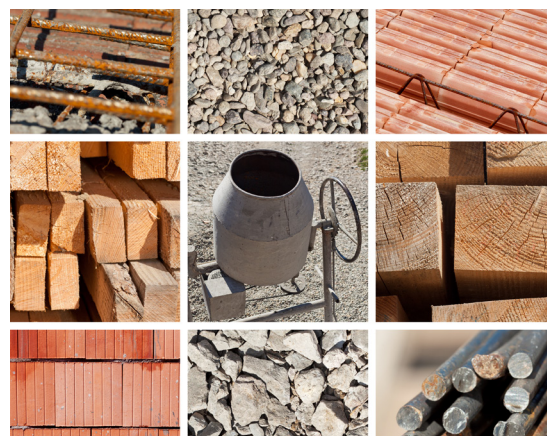


Figure 1: Different materials such as brick, concrete, wood, and rebar are chosen for their unique strengths to create safe and durable structures.

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The Foundations of Making Materials

Have you ever wondered where materials come from? Things like plastic, and foam don't start that way. They are **made**. Some materials even begin in nature. Rubber, for example, can come from rubber trees. The tree makes a milky liquid called latex, and people collect that latex and process it to make natural rubber. Rubber can stretch, bend, and bounce, which is why it's used in things like tires, gloves, rubber bands, balls, and shoe soles. But rubber doesn't come off the tree ready to use. It still has to be collected, mixed, shaped, and processed before it becomes the materials and products we use every day.

Today, you get to be a maker, too. In today's activity, we will be making our own material. You will start with simple ingredients and follow steps to mix and work them together. As you do, you will see the material change right in your hands.

People who make materials in factories do this every day. They follow steps, use tools, and pay close attention to what happens as materials are mixed and worked. If a material doesn't turn out the right way, they change what they do and try again.

As you make your material today, you'll be practicing the same kinds of skills that makers and engineers use. By the end of the activity, you'll have created a new material on your own—just like real builders and engineers do.

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

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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



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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

- What can you tell me about glue?
- What do you think will happen to the glue when we mix our materials together?
- How did the glue change when we mixed our materials?
- What can our new material do now that it couldn't do before we mixed our materials?

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Variations and Enrichment

- Teacher-led demonstration: Extra time in the solution
 - When the putty spends additional time in the Borax solution, the material becomes more stiff, loses stretchiness, and will begin to break instead of stretch. This can reinforce the notion that more is not always better, and that processing a material too much may make the material stop working the way you want
- Group experimentation: Two groups use the same materials, and one group changes one step
 - Group A produces the silly putty to spec
 - Group B changes one variable to their putty (e.g: More/less glue, more/less solution, more/less time in the solution)

Foundation Exploration

- **Bakers** mix ingredients like flour, water, and eggs to make new materials, like dough and batter
- **Paint makers** mix colors known as pigments, and various liquids and binding agents to create paints that are strong, durable, and vibrant
- **Factory workers** help make materials and products by following steps, and watching for changes
- **Engineers** help decide how materials should be made so that they work the right way



Figure 2: Bakers mix ingredients to create new materials, like dough and bread.



Figure 3: A painter mixes colors to create new shades with different appearances.