Push and Pull: Ideas of Migration in the Beehive State

Art Meets Science: Self-Assembling Salt Sculptures

William Lamson's *Hydrologies Archaea*

Summary:
Students will gain inspiration from William Lamson's *Hydrologies Archaea* to create their own self-assembling salt crystal sculpture as a collaboration between artist and nature.

Curriculum Ties:
K-2 Integrated Core- Standard 1, Objectives 2, 3
Fine Arts- Visual Arts- Grades 3-6- Standards 1-4
Fine Arts- Visual Arts- Foundations I and II- Standards 1-4
Science- Grades 3, 4- Standard 3
Science- Grades 5, 7, 8- Standard 1
Science- Chemistry- Standards 3, 6

Time Frame:
45 minutes plus 3+ days for observing changes

Materials:
- Saucepan and stove
- Water: about 1 cup per student/sculpture
- Salt: about ½ cup table salt per student/sculpture
- Food coloring (optional)
- String: about 3 feet per student/sculpture
- Small plastic cups or jars that can hold hot liquid
- Plates or trays to put under cups
- Newspaper to cover work area

Resources:
Website: William Lamson
www.williamlamson.com

William Lamson is an American installation and performance artist who utilizes photography and video to document his work. His artworks are based on interactions with the natural and man-made environment, and may include the use of homemade machines to harness the powers of wind, water and the sun. He explores themes such as masculinity, amateurism, science and personal heroism while maintaining a sense of play and experimentation. Projects have included: *A Line Describing the Sun*, in which he follows the path of the sun across a lakebed in the Mojave Desert with a makeshift moveable lens, burning a 366 foot arc into the earth; and *Solarium*, a glass house made up of rectangles of caramelized sugar sealed between panels of glass.

Website: Nanoscale Informal Science Education Network
Self-Assembly Learning Games for Ages 4-Adult
www.nisenet.org/catalog/programs/ready_set_self-assemble

Background For Teachers:
Students should understand the following vocabulary for this activity:

Solution: A solution is a mixture of two or more substances in which each substance is distributed evenly throughout. A solute is what is dissolved, and a solvent is the substance the solute is dissolved into. Saturation describes when the maximum amount of solute has been dissolved into the solvent. Solutions can be made up of various combinations of gases, liquids and/or solids.

Crystal: A crystal is a solid material made up of molecules that fit together in a repeating pattern. Crystallization occurs most often when liquids cool or evaporate. Certain molecules begin to gather together in an attempt to stabilize, creating a uniform pattern specific to the ingredients that make up the substance and the conditions in which it crystalizes. For example, salt crystals form when salt water evaporates, and diamonds form when liquid rock made up of carbon cools slowly.

Self-Assembly: Common in the natural world, self-assembly is a process by which molecules and cells organize themselves into functional structures. This happens millions of times a day in a variety of ways. In fact, all living things, including human beings, contain structures that are self-assembled. A prime example in humans is the construction of DNA. Genetic codes and sequences guide the process of self-assembly, which occurs under specific conditions. Scientists study the self-assembly of crystals for practical applications in human technology. (Source: www.nisenet.org/catalog/programs/ready_set_self-assemble)

Sculpture- A sculpture is a 3-dimensional artwork, whether made of metal, wood, clay or found materials.

Form- Form pertains to volume or perceived volume. Three-dimensional form is the basis of sculpture. However, two-dimensional artwork can achieve the illusion of form with the use of perspective and shading techniques. (Source: Wikipedia)

Texture- Texture is used to describe either the way a three-dimensional work actually feels when touched, or the visual "feel" of a two-dimensional work. (Source: Wikipedia)

Color- Color is the element of art that is produced when light, striking an object, is reflected back to the eye.

There are three (3) properties to color. First is hue, which simply means the name we give to a color (red, yellow, blue, etc.).

The second property is intensity, which refers to the strength and vividness of the color. For example, we may describe the color blue as "royal" (bright, rich, vibrant) or "dull" (grayed).

The third and final property of color is its value, meaning its lightness or darkness. The terms shade and tint are in reference to value changes in colors. (Source: Wikipedia)

Elements of Art- http://en.wikipedia.org/wiki/Elements_of_art
Shape, form, color, line, value, space, texture

Principles of Art- http://en.wikipedia.org/wiki/Principles_of_art
Movement/rhythm, unity/harmony, variety, balance, proportion/scale, pattern, emphasis

Intended Learning Outcomes:

Understand that crystals are non-living structures that form in nature through self-assembly.
Understand that salt crystals form when salt water evaporates, and that salt is an important characteristic of Salt Lake City's geography and identity.
Understand that natural environmental processes can be utilized by artists to create visual art.
Understand that science and art are not mutually exclusive.

Instructional Procedures:

Lead your students in a discussion to introduce the basic materials and science concepts involved in the activity. Display images of William Lamson's *Hydrologies Archaea* as an example of an artist using these concepts to create a sculpture. Ask your students about the importance of salt to the geography, industry and culture of Utah. Explain that they will now have a chance to create their own self-assembling salt sculpture.

Questions to be asked during the discussion:

- How did these sculptures form?
- What substance does it look like they are made out of?
- What is crystallization? What might self-assembly mean? Can you think of other examples from nature of crystallization or self-assembly (i.e. minerals, DNA, snowflakes)?

What role do atoms and molecules play in self-assembly?
Is the artist responsible for the creation of these salt sculptures? Or is nature? Both?

To create the sculptures, first have students cut their string into 6 or 7 pieces, each about 5 inches long, and tie them together at one end so they look like a string bouquet.

To prepare the salt solution, bring the water to a rolling boil in the saucepan. Add the salt and a couple of drops of food coloring (optional). Mix with a spoon to help the salt dissolve. Continue adding salt and mixing until no more salt will dissolve into the water. You should now have a "supersaturated" solution. You might notice a film of salt crystals forming in a layer on the surface of your solution. At this point, turn off the heat and pour the solution into the plastic containers, one cup per student. You may have to repeat the above instructions to provide enough solution for your whole class, or have students work in groups.

Students should submerge the knotted end of their strings into the solution, and arrange strings evenly so that the ends dangle over and around the rim of your container. Leave the containers someplace where they are not likely to be disturbed. You might want to put a newspaper or paper towel under them to catch the drippings from the ends of the strings.

Wait. In a couple of days you should be able to see that the strings have grown fatter from the crystallizing salt. If you continue adding salt solution when it's evaporated below the knot, you should be able to grow long salt stalagmites. (Source: www.exploratorium.edu)

Have each student record observations of their sculpture through picture and/or words on the first day and each subsequent day of the project.

Questions to be asked during the art-making process:

What do you see?
Does the texture of the sculpture change over time?
Could you make different shapes with the string to form different shaped or sized salt formations?
What happens if you add a different color of salt water to your cup on day two or three?
Do you think the salt would crystalize on any other material besides string?
Why are the properties of water important to drawing the salt up the string?
Are these crystals a living or non-living thing? Can non-living things grow? What other non-living things assemble structures on their own (i.e. minerals, DNA, snowflakes)?
Do the salt and/or water undergo any physical or chemical change?

Extensions:

Have students set up true scientific experiments with independent variables that may include: type of string, type of salt, length or shape of string, using other kinds of materials for the structure of the sculpture, and more.

For students in Chemistry, use as a hands-on introduction to learning about solutions and/or bonding on the atomic and molecular level.

Example Images:

Collecting water from the Great Salt Lake

Hydrologies Archaea
Installation View
Utah Museum of Contemporary Art