THE SCIENCE OF EGG TEMPERA PAINTING

COMMON CORE AND NEXT GENERATION SCIENCE STANDARDS

CCSS ELA-LITERACY RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
CCSS ELA-LITERACY RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (eg. in a flowchart, diagram, model, graph, or table).
NGSS DCI MS PS 1-1.
Develop models to describe the atomic composition of simple molecules and extended structures.
NGSS DCI MS-PS 1-3.
Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

OVERVIEW

Before the invention of oil paint, artists created paintings with powdered colored pigments mixed with egg yolk as a binding agent. Artists ground stones and minerals into powder to create different colors. Renaissance artist Carlo Crivelli utilized this egg tempera painting technique to create panel paintings like the *Virgin and Child with Saints and Donor*. Students will examine a Renaissance painting and explore the use of egg tempera painting materials and techniques.

MATERIALS NEEDED

- Copies of *Virgin and Child with Saints and Donor*
- Eggs (2 per student pair)
- Artists' pigments (Artists' pigments like those made by Gamblin paints are most closely related to the pigments ground by Medieval and Renaissance artists. If artist pigment isn't available, regular powdered tempera or cakes that can be ground will also work.)
- Paper towels
- Small mixing bowls (2 per student pair)
- Toothpicks or pointed tool
- Mixing spoons, popsicle sticks, or other mixing tool (2 per student pair)
- Water
- Paint brushes
- 8"x 10" watercolor paper (2 pages per student pair)

EXPLORING THE OBJECT WITH STUDENTS

- Today most artists buy their paint but artists hundreds of years ago made all of their own materials. Tempera paint used by Medieval and Renaissance artists consisted of pigment and binder in the form of egg yolk. Honey was sometimes added to keep the paint from drying too quickly, and water was also added to thin the paint.
- Pigment is what gives color to paint. The pigment particles are insoluble (they won't dissolve) and form a suspension in the binder. There are many pigments in the world from a variety of sources. The first pigments came from the earth in the form of minerals, vegetables, or animals. There are also many binders for pigments that create different types of paint including, acrylic, watercolor, or egg tempera. Each binder gives a unique quality to the pigment and adheres to the surface in a different way. What colors are used throughout the *Virgin and Child with Saints and Donor*? What natural materials do you think were ground to create pigments for these paint colors?
- What is an emulsion? An emulsion is a colloidal suspension of a liquid in another liquid. Paint is a special type of emulsion because the pigment particles are suspended in a liquid (emulsifier) such as oil, egg yolk, or even glue. When emulsions are spread out the emulsifier is able to harden.
- Have you ever cracked open an egg and left it out for too long? Because egg tempera is made with egg yolk it dries very quickly and it cannot be stored. Artists had to work very quickly and in small areas at a time. For Medieval or Renaissance artists making their own paint, mixing too little of one color made it challenging to create an exact match if more paint was needed and mixing more paint than needed was a waste of precious materials.

ACTIVITY

1. Divide students into small groups or pairs and distribute materials.

2. Crack an egg over a bowl and separate the yolk from the white by pouring the yolk from one half of the shell to the other, allowing the white to fall into the bowl below.
3. After all of the egg white is gone, gently pour the intact egg yolk into the palm of one hand. Carefully roll the egg yolk from one hand to the other, each time wiping your free hand on a paper towel to remove the excess egg white.
4. When the egg yolk is completely dry, gently pinch the yolk between two fingers and hold it over a clean bowl. Puncture the yolk with a toothpick or sharp tool and drain the contents of the yolk sac into the bowl. Discard the yolk-sac when finished draining. Always wash with soap and dry your hands thoroughly after handling raw eggs.
5. Add powdered pigment a little at a time to the egg yolk and mix until the powder is fully incorporated and the paint is the desired color.
6. Next, slowly add a small amount of water until the paint is fluid and can be used with a brush. Tempera paint that is too thin or thick will crack as it dries. How does the amount of emulsifier (egg yolk or water) impact the properties of the paint?
7. Paint a swatch of your egg tempera paint onto watercolor paper. Notice how long it takes the paint to dry. Experiment with mixing different colors and consistencies and observe the difference when the paint is wet and dry. Choose a color found in the *Virgin and Child with Saints and Donor* to recreate using egg tempera paint. How does egg tempera paint compare to contemporary paints you may have used?

EXTENSION

- Create a paint swatch sampler using a variety of paints and pigments. Compare and contrast the properties of different materials.
- Explore additional panel paintings and works of art by Renaissance artist Carlo Crivelli online at http://art.thewalters.org/.
- Research the origin of artist pigments and their development throughout the Medieval and Renaissance periods.
- Create your own paints and pigments using fruits, vegetables, or other natural materials.

Virgin and Child with Saints and Donor, Carlo Crivelli, ca. 1490 (Renaissance)