STEAM: Science, Technology, Engineering, Art, and Math
Workshop Lesson Plan for Middle School Students
2017-2017 School Year

What's the Big Idea?
Creative Problem Solving and Experimentation

STEAM Tour and Workshop Purpose
Students will use the High’s collections as evidence of creative problem solving, learning directly from the objects how artists create innovative solutions to complex problems.

Essential Questions
Use the following guiding questions as you lead your students through the workshop:

• What can we learn from the artistic process to become creative problem solvers in the twenty-first century?
• How is an artist similar to a designer, explorer, or scientist?
• How do artists experiment with materials and processes?

Objectives
Students will …

• make connections between how artists use creative problem solving to create their works of art
• use creative problem-solving techniques to create works of art
• work collaboratively with peers
• explore connections between scientific concepts and art-making processes

Procedures
1. Introduction: Teaching Artists will begin by welcoming students to the paint and color science lab. During this one-hour workshop, students will have the opportunity to experiment with various painting processes and materials. Artists, including many whose work is on view at the High Museum, think like scientists. They conduct experiments with materials and processes to push the boundaries of art-making and discover new ways to create art.

During this workshop, students will move from station to station to experience firsthand how artists are creative problem solvers who experiment to come up with new ideas and solutions.

The Teaching Artist will introduce a variety of exemplar artists in the High’s collection to highlight the variety of ways that artists use paint and color. Questions for reflection as a group: How are these artists creative problem solvers? In what ways might these artists have experimented?
2. **Station Options:**

*Teaching Artist will setup 2-3 stations per workshop.*

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| **Watercolor Test Tiles** | Each student will receive 4 watercolor paper test tiles. After examining watercolor paintings in the High Museum of Art’s collection, students will experiment with the following materials.  
   1. Salt  
   2. Vegetable Oil  
   3. Crayon  
   4. Rubbing Alcohol  
Students will write the material they are experimenting with in the top corner of the test tile before painting. Students will document how the material affected the watercolor on the back of each card. | - Sharpies  
- Pencils  
- Watercolor trays  
- Salt  
- Vegetable Oil  
- Rubbing Alcohol  
- Paint Brushes  
- Trays  
- pipettes  
- Water cup  
- Watercolor paper | Each material impacts the watercolor paint differently. –  
- Rubbing Alcohol- Water is considered a *polar molecule* which means the molecules tend to stick together. Rubbing alcohol is not a polar molecule, therefore the water tends to move away from the alcohol.  
- Salt absorbs moisture and repels pigments  
- Water and oil have different densities. Oil is less dense and water is more dense and will float on water. Oil molecules are also non-polar meaning they only have negative charges along the outside. |
| **Pendulum Painting** | Artists experiment with different ways of applying paint to works of art. Students will experiment with painting using a pendulum. Students will add paint to a small bottle that is attached to the pendulum device with a string. The student will then pull the paint tube away from the device and let the bottle swing freely to create a design. Students will take turns operating the pendulum painting and observing how different starting angles affects the trajectory of the paint. | - Pendulum Structure (tape to table)  
- Masking tape  
- Tempera paint (watered down)  
- Bottle  
- Paper | A pendulum is a fixed object hung from a point so it swings freely back and forth due to gravity. Once the pendulum is set in motion, it will slowly turn in a clockwise direction due to the rotation of the earth. |
| **Magnet Painting** | Students will explore how magnets affect other objects. A piece of paper will be placed on the bottom of a containers. Various metal objects and magnets will be placed in the container in addition to small amounts of paint. Students will hold the magnet wand under the container and move it around. As it attracts and repels objects in the container, students will create designs and | - Paper  
- Plastic Container  
- Blocks  
- Tempera paint  
- Magnets  
- Magnet wands  
- Metal objects | A magnet has two poles, north and south. Magnets either attract or repulse each other, or other objects, depending on the orientation of the poles. |
explore color mixing.

Chromatography

Students will draw a simple design near the center of a coffee filter using washable markers. Students should avoid the area about one inch from the middle. Then, they will fold the filter into a triangle from the middle. Students will place the tip of the folded filter in water and observe how the colors change as the water is absorbed by the filter.

- Coffee filter
- Washable markers
- Clear cups
- Button or round object

As the water moves up the absorbent paper, it carries the color with it. The mixture of the ink is dissolved and the components separated due to their attraction to the paper or their solubility. Because the ink ingredients are not chemically bonded, they can be separated.

3. **Project Logistics:** Students will have approximately 40 minutes to move freely between art experiments. Adjust time as needed and utilize a visual timer to indicate remaining work time.

4. **Cleanup:** Allow 5 minutes for students to cleanup materials and collect their final works of art. Lead a class discussion and reflection utilizing the following questions:

- What surprised you today during your art experiments?
- What discoveries did you make?
- Did you make any mistakes? If so, how would you do it differently?
- Now that you’ve completed these experiments, how do you think that art and science are related?
- How are artists similar to scientists?
- How do artists solve problems?
Vocabulary
Prototype
Installation
Site-specific
Commission
Design
Structure
Community

Materials for the Instructor
Timer
Graph paper (1 sheet per table)
1 container with 6 Design Challenge Cards