Lesson 1: Metric Units and Conversions Review

Taught by: Laura Romesberg
Subject: Life Science & Grade 7
Estimated Time to Complete: 1.5 periods (80 mins.)

California Content Standards to be addressed:
Science Content Standards- Investigation and Experimentation

7. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:
   a. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.
   d. Construct scale models, maps, and appropriately labeled diagrams to communicate scientific knowledge (e.g., motion of Earth’s plates and cell structure).

Note: To complete the above standards students need functional understanding of the metric system which most entering seventh grades students do not have.

Mathematics Content Standards
Students make conversions between different units of measurement.

I. Content:
   * Students will be able to identify the different metric units.
   * Students will be able to convert units and use proportional reasoning to create a scaled object.

II. Instructional Objectives:
   * Students will create a full-scaled authentic geological Jacob Staff.
   * Students will create a mini-Jacob Staff 1/10 size of original.

III. Instructional Procedures:
1. Review metric units and conversions.
2. Brainstorm how scientists/geologists might accurately scale their drawings.
3. Introduce a Jacob staff and its uses by geologists. (show a model drawing and actual Jacob staff shown)
4. Groups of four students create their own Jacob staff using a precut 2 meter pvc pipe. They will color-code units using electrical tape. Every 10 cm marked (1 dm) black; 50 cm (5 dm) increments marked green; and each 100 cm (1m) in red.
5. Brainstorm methods to scale down this tool by 1/10.
6. Each student will use a straw & Sharpie™ pens to create a mini-Jacob staff. (scale: 1 decimeter=1 centimeter)
IV. Materials and Equipment:
* a metric worksheet showing common SI prefixes and conversion practice
* one pre-labeled Jacob staff
* sample scaled drawings
* (8) precut 2 meter length pvc pipes
* colored electrical tape
* plain straws
* colored Sharpie® pens (red, green and black)

V. Assessment/Evaluation
* Student staffs will be compared to teacher's model for accuracy (authentic assessment)

VI. Follow-up Activities
* Students will use both the full sized and mini-Jacob staffs to complete a scaled down drawing in the field. (See Lesson 3: Geological Field Drawing)
Lesson 2: Scale Drawing

Taught by: Jenny Austin
Subject: Art - Grade 8
Estimated Time to Complete: 3-5 class periods

California Content Standards to be addressed:
Visual and Performing Arts: Visual Arts Content Standards

1.0 Artistic Perception
Processing, Analyzing, and Responding to Sensory Information Through the Language and Skills Unique to the Visual Arts. Students perceive and respond to works of art, objects in nature, events, and the environment. They also use the vocabulary of the visual arts to express their observations.

Develop Perceptual Skills and Visual Arts Vocabulary
1.2 Identify and describe scale (proportion) as applied to two-dimensional and three-dimensional works of art.

Analyze Art Elements and Principles of Design
1.3 Identify and describe the ways in which artists convey the illusion of space (e.g., placement, overlapping, relative size, atmospheric perspective, and linear perspective).

1.4 Analyze and describe how the elements of art and the principles of design contribute to the expressive qualities of their own works of art.

2.0 Creative Expression
Creating, Performing, and Participating in the Visual Arts
Students apply artistic processes and skills, using a variety of media to communicate meaning and intent in original works of art.

Skills, Processes, Materials, and Tools
2.2 Use different forms of perspective to show the illusion of depth on a two-dimensional surface.

2.4 Develop skill in mixing paints and showing color relationships.

Communication and Expression Through Original Works of Art
2.7 Create a series of works of art that express a personal statement demonstrating skill in applying the elements of art and the principles of design.

I. Content:
* Students will be able to accurately scale and replicate a photo using appropriate tools and techniques.

II. Instructional Objectives:
* Students will create a 2 meter high drawing of a geological rock face from a 8x5 photo.
* Students will mix paints to match the natural colors of the photo.
* Students will paint the drawing showing 3-dimensional feature demonstrating illusion of depth.
III. Instructional Procedures:
1. Review of skills and techniques of foreshadowing and shading to show depth.
2. Brainstorm how artists might accurately scale their drawings.
3. Share samples of scaled work and the original picture.
4. Demonstrate scaling technique using the standard folding method.
5. Students will work in pairs to apply the folding technique to enlarge their photos 10-fold into a pencil sketch. They will then paint their sketch using details, foreshadowing, shading, and matching the color of the photo.

IV. Materials and Equipment:
* photos of geological rock faces
* sample drawings of scaled work
* butcher paper (2 meters long)
* tempura paint
* painting supplies

V. Assessment/Evaluation
* Compare student paintings to original photo checking for accuracy of scaling, coloring, and details.
* Note evidence of foreshadowing and shading to bring out 3-D illusion.

VI. Follow-up Activities
* Student scaled self-portrait.
Lesson 3: Geological Field Drawing

Taught by: Laura Romesberg
Subject: Life Science & Grade 7
Estimated Time to Complete: 2-3 periods

California Content Standards to be addressed:

Investigation and Experimentation
1. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:
   a. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.
   d. Construct scale models, maps, and appropriately labeled diagrams to communicate scientific knowledge (e.g., motion of Earth’s plates and cell structure).

Note: Standards below will only be touched upon in this lesson and later met through follow-up activities.

Evolution
1. Biological evolution accounts for the diversity of species developed through gradual processes over many generations. As a basis for understanding this concept:
   a. Students know both genetic variation and environmental factors are causes of evolution and diversity of organisms.
   c. Students know how independent lines of evidence from geology, fossils, and comparative anatomy provide the bases for the theory of evolution.

1. Evidence from rocks allows us to understand the evolution of life on Earth. As a basis for understanding this concept:
   a. Students know Earth processes today are similar to those that occurred in the past and slow geologic processes have large cumulative effects over long periods of time.
   c. Students know that the rock cycle includes the formation of new sediment and rocks and that rocks are often found in layers, with the oldest generally on the bottom.
   d. Students know fossils provide evidence of how life and environmental conditions have changed.
   g. Students know how to explain significant developments and extinctions of plant and animal life on the geologic time scale.

I. Content:
* Students will be able to use their measuring tools and observation skills to complete an accurate scientific drawing.

II. Instructional Objectives:
* Students will use their Jacob staffs to measure actual rock formations reproduced by eighth grade art students. (see Lesson 2: Scale Drawing)
* Students will use their mini-Jacob staffs to produce an accurate 1/10 scale drawing “in the field.”
Students will observe the rock face for shape, color and details and record accurate placement of fossils, minerals and/or other geological features.

III. Instructional Procedures:
1. Brainstorm skills of a scientist including observation and accurate recording of evidence.
2. Demonstrate how a Jacob staff is used in the field for scaling.
3. Review the purpose of the mini-Jacob staff. (scaled drawing)
4. Students choose "rock faces" created by 8th graders to draw.
5. Students work individually to replicate their chosen "rock faces".

IV. Materials and Equipment:
* large scale geological rock faces paintings
* full sized and mini-Jacob staffs
* 8x10 white paper
* color pencils
* pencils, erasers and clipboards

V. Assessment/Evaluation
* Compare student drawings to original photo checking for accuracy of scaling, coloring, and details.

VI. Follow-up Activities
* Students create scientific drawings throughout the year and will be held to the requirements and standards of excellence established in these lessons.
* These drawings of geological rock faces and fossils will be referred to and used later in the studies of geology, evolution, and comparative anatomy.