

TIES 2003

Teachers in Industry for Educational Support

Integrating Art in Math and Science Curriculum

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Table of Contents

	<u>Page</u>
Curriculum Unit Overview - narrative	3
Summary Chart	4
Section One Math	5-9
Section Two Science	10-16
Section Three Art	17-22
Transfer Activity School Spirit: Designing a School Statue	23-24

Integrating Art in Math and Science Curriculum

Curriculum Unit Overview

Summary

Using the permanent collection at the Dayton Art Institute, lesson plans were developed for the Educational Resource Center. This unit ties together math, science and art for sixth graders. The entire unit would take approximately two weeks to complete, including a trip to the Dayton Art Institute.

Big Picture

This unit allows the students to apply math and science concepts to pieces of artwork. The unit challenges the students to use the skills learned in classroom to evaluate another subject matter. Students also must use visualization skills and computer technology to successfully complete the unit.

Preparation for the Unit

Work with the Education Department at the Dayton Art Institute to:

Make arrangements for a field trip to the museum, including the scheduling of docents to lead the students through the museum.

Overview

On the following page is a summary of the unit including brief summaries of each Authentic Learning Task (ALT). This table provides an overview of the tasks in the unit sections and shows how the activities in the different teaching areas relate to each other.

Integrating Art in Math and Science Curriculum

Curriculum Unit Summary

Math	Science	Art
<p>ALT 1 - Lines and Angles The students will study, recognize, and identify parallel, perpendicular and intersecting lines. They will practice these skills using a straightedge and protractor.</p>	<p>ALT 1 - Identifying Minerals The students will identify the basic properties of minerals. They will examine samples of different minerals to develop a classification system based on mineral properties.</p>	<p>ALT 1 – Media The students will create representations of on object using two or more different media.</p>
<p>ALT 2 – Geometric Shapes The students will study, recognize and identify geometric figures. They will use pattern blocks and graph paper to create a tessellation.</p>	<p>ALT 2 - Rocks The students will identify the basic properties of rocks. They will examine samples of different rock types to develop a classification system based on rock properties.</p>	<p>ALT 2 - Creative Expression The students will be able to describe the mood, feelings or themes associated with artwork of different media.</p>
<p>ALT 3 - 3-Dimensional Math The students will find the perimeter, area, and volume of cubes, pyramids, and prisms.</p>	<p>ALT 3 - Materials of Sculpture The students will tour the Dayton Art Institute looking at the rocks and minerals used for sculpture. They must use their knowledge of the properties of these materials to answer questions about the pieces of sculpture.</p>	<p>ALT 3 – Technology The students will be able to identify and use technology to create original artwork.</p>
<p>Transfer or Culminating Activity</p> <p>The students will be given the assignment to create a sculpture for the school. They are to choose a theme for the sculpture and decide upon the mood and feeling they want to create. They should then justify their choices of materials and shape. They must describe their material and the process necessary to change this material into the desired sculpture. Student will create a computer generated image of their sketch along with a verbal defense of their design and technique.</p>		

Section One: Math

ALT One: Lines and Angles

Summary

Students will study line and angles. They will correctly draw and identify three types of lines (parallel, perpendicular and intersecting) and measure and identify acute, obtuse, and right angles. They will properly label their drawings and demonstrate correct techniques with the protractor.

Competencies

- 1 Identify, describe and classify types of line and angles.
2. Make precise and accurate measurements using the ruler and protractor.

Time

The students will need two hours to complete this section. Additional time to finish their project can be assigned for homework.

Materials

Each student will need to have a metric ruler and a protractor
Plain paper (9" x 12")

Instructions

- i. Students will draw and label correctly the lines and angles assigned on the handout "Lines and Angles.
- ii. Students will use lines and angles to create a street map of their neighborhood or the area in and around the school.

Evaluation/Assessment of Student's Competency

Students' work will be evaluated for accuracy and correct identification. The maps will be displayed in the classroom as examples of line and angles in the real world.

Closure

A follow up discussion of lines and angles will be held, using their maps as a focal point. These one dimensional drawings will be a lead into two dimensional shapes and polygons that they will be using for the Second Sectional.

Section One: Math

ALT Two: Geometric Shapes and Polygons

Summary

Students will use a straightedge and protractors to draw and construct different sized rectangles, triangles, trapezoids, and parallelograms. They will correctly measure and labels the area and perimeter of each geometric shape.

Competencies

1. Formally define geometric figures.
2. Use geometry to represent and examine properties of geometric figures.

Time

Students will need two hours to complete this section, including instruction time and demonstration of the use of the tools. Additional work not completed in class can be assigned as homework.

Materials

Each student will need to have a metric ruler and protractor.

Plain drawing paper (9" x 12")

Pattern blocks

Scissors and glue sticks

Colored pencils or markers.

Optional: Colored construction paper

Instructions

1. Instructor will demonstrate and model the correct method to create and draw geometric figures.
2. Students will practice making the same figures on their papers.
3. Students use proper equations to calculate the perimeter and area of each shape, and label correctly.
4. Students will create a tessellation, using the pattern block handout. These can be colored and cut out, or traced onto colored construction paper.

Evaluation/Assessment of Student's Competency

Students' papers will be scored as to accuracy and skill of measurement, as well as neatness and proper labeling. A score of 85 % will be considered mastery. The tessellation will be displayed in the classroom as visual examples of two dimensional shapes.

Closure

A discussion of the polygons and the skills used in this section will be reviewed. The displays of the tessellation and the students' maps allow students to compare the two types of geometry. With experience and practice in these first two sections, the students will be ready to continue to ALT Three, that extends the geometry unit into three dimensional figures.

Section One: MATH

ALT Three: Three-dimensional Objects

Summary

Students will study, identify, and learn to draw three-dimensional geometric objects (cubes, pyramids, and prisms). They will correctly recognize the faces, vertices, and bases of each.

Competencies

1. Formally define geometric figures.
2. Draw and construct representations of three-dimensional objects using straightedge and compass.
3. Use technology to construct three-dimensional drawings.

Time

Students will need two hours to complete this section. One hour would be instruction and practice of in drawing three-dimensional geometric figures. The other hour would be in the computer lab or done where computers are available. The students should have the opportunity to print the computer generated drawing if possible.

Materials

Each student will need to have a straightedge and protractor.

Plain drawing paper (9" x 12")

Computers with 3-D software (depending of the type computer the school uses)

Instructions

1. Students will observe the instructor's demonstration of drawing three-dimensional geometric shapes.
2. Students will complete these drawings on their papers, as well as identify and label the bases, faces, and vertices of each.
3. Students will use 3-D software to create drawing of prisms, pyramids, and cubes.

Evaluation/Assessment of Student's Competency

Students' papers will be evaluated for accuracy and correct labels. Additional practice from the student text or worksheet maybe assigned if students need more reinforcement.

Closure

A review discussion will help the students remember three-dimensional shapes and vocabulary. The printed copies of the computer generated work will be visual reminders of these geometric shapes. Students should be encouraged to continue practice drawing or creating these figures in different sizes and positions.

Section Two: Science

ALT One: Identifying Minerals

Summary

Minerals have physical properties that can be used for identification. Students will use color, luster, hardness, streak, density, crystal shape, cleavage and fracture, and special properties to identify samples of minerals. The teacher will introduce the identifying physical properties and the methods used to identify minerals. Students will then be given samples of minerals, which they must identify.

Competencies

1. Students will identify minerals by their characteristic properties.
2. Students will make and record accurate observations in a data table.
3. Students will use the data they collected to make inferences about the identity of a sample of a mineral.

Time

Approximately 50-60 minutes should be devoted to the introduction of minerals and their physical properties. Another 50-60 minutes should be used to allow students to identify samples of minerals.

Materials

Samples of common minerals
Observation and prediction data sheet
Mineral Identification field guides
Mohs Hardness Scale
Magnifying glasses
Streak plates
Copper pennies
Dull kitchen knives
Glass plates
Steel files
Magnets

Instructions

1. The teacher should introduce minerals by defining minerals and explaining how they are formed.

2. The teacher should next present the characteristic physical properties that are used to identify minerals, including color, luster, hardness, streak, density, crystal shape, cleavage and fracture, and other special properties.
3. The teacher should set up stations for each sample mineral they have for the students to identify. Each station should have a sample of a mineral, a mineral identification guide, a magnifying glass, a streak plate, a copper penny, a dull kitchen knife, a glass plate, a steel file, and a magnet.
4. The students will be split into groups, according to the number of students and the number of stations/minerals available. Each group will be given 10-15 minutes at each station to record observations about the sample. The students should record the color, luster, cleavage, and fracture of the mineral. They will scrap the sample on the streak plate to determine the streak. They will also scrap the mineral on a penny, knife, glass, and steel file to determine the hardness, based on Mohs Hardness Scale. Finally the magnet can be used to determine if the sample has magnetic properties.
5. Using their observations, the students will use the mineral identification guide to determine the identity of the mineral present at that station.
6. Students will then proceed to the next station. When completed with all stations, students should review their predictions.

Evaluation/Assessment of Student's Competency

The teacher should collect the students' data and prediction sheet. The students will be assessed on their ability to use the tools to determine the physical properties of the sample, their neatness and organization of data, and the accuracy of their identification of the minerals.

Closure

The teacher should review each of the samples and provide the students with the correct properties and identity of the mineral. The teacher should also begin to introduce the uses of minerals. Common examples of minerals should be presented so that students understand how minerals can be used in everyday life. The teacher should also introduce minerals as the building blocks for rocks. This will lead to ALT Two: Rocks.

Science ALT One: Handout One

Mineral Observation and Prediction Data Sheet

#	Color	Luster	Hardness	Streak	Cleavage	Special Properties	Prediction

Section Two: Science

ALT Two: Rocks

Summary

Students will use their knowledge of minerals to begin the process of identifying rocks. The students will each bring in a rock they have located from the local area. Students will study the characteristics of these rock samples to develop the general characteristics of different types of rocks.

Competencies

1. Students will be able to explain how rocks are made from one or more minerals.
2. Students will be able to recognize the distinct properties of igneous, sedimentary, and metamorphic rocks.
3. Students will make and record accurate observations in a data table.

Time

Approximately 50-60 minutes should be used to introduce rocks and the rock cycle. Another 50-60 minutes should be devoted to the investigation of rock samples. Approximately 20 minutes of a following class period should be devoted to reviewing and making final identification of the rocks.

Materials

Samples of rocks
Rock Identification field guides
Magnifying glasses

Instructions

1. The teacher should introduce the study of rocks by explaining the rock cycle and how rocks are formed from minerals. The teacher may also introduce some of the characteristics of different types of rocks (i.e. color, texture).
2. The teacher should ask students to find a rock and bring it in for the following day. The teacher should suggest places to find the rocks, including the school grounds, backyards, gardens, parks, etc.
3. The following day the students will examine the rock samples, looking for characteristic properties. The students will use rock field guides to identify the rocks based on their properties.

4. The teacher should have students share the rocks they brought with the class. After all the students have shared their rocks, the teacher should have the class make comparisons of the rocks. The ultimate goal being to identify the common types of rock present in the area surrounding the school.

Evaluation/Assessment of Student's Competency

Students will be awarded credit for bringing in a rock sample. Assessment of the students' learning should be gained from the accuracy of their identification of the rock.

Closure

The teacher should introduce other types of rocks that were not investigated in class. The class should be able to compare and contrast the different rocks and their properties. A good understanding of rock properties will help the students as they participate in the "Materials of Sculpture Tour" at the Dayton Art Institute.

Section Two: Science

ALT Three: Materials of Sculpture

Summary

The students will use their knowledge of rocks and minerals as they tour the Dayton Art Institute. The class will participate in a self-guided tour that examines the materials that are used for sculpture. The tour highlights the materials, their properties, and chemical and physical changes of the materials.

Competencies

1. Students will be able to identify the materials of sculpture in the permanent collection at the Dayton Art Institute.
2. Students will be able to identify the properties of the specific materials that suit them for sculpture.
3. Students will be able to identify chemical and physical changes that occur during the creation of the sculpture.

Time

“The Materials of Sculpture Tour” takes approximately two hours. Additional time should be added for travel time and other viewing at the Dayton Art Institute.

Materials

“The Materials of Sculpture” Educator Resource Packet, including self-guided tour and student handouts. (Available from the Dayton Art Institute Education Department).

Instructions

1. The teacher should contact the Education Department at the Dayton Art Institute in order to secure the Educator Resource Packet. The teacher should also make arrangements for a field trip to the Dayton Art Institute, considering travel needs, lunch accommodations, and permission slips.
2. The teacher should have introduced minerals, rocks, and chemical and physical changes previous to the trip to the museum.
3. The class should follow the self-guided tour around the Dayton Art Institute and allow students time to make observations and record answers on their handouts.
4. On the following day, the teacher should review the materials of sculpture and their properties. This activity is a good final review of the rocks and minerals unit.

Evaluation/Assessment of Student’s Competency

Students should be evaluated on their behavior at the museum. Additionally, the student handouts should be assessed to ensure the students participation at the museum and their understanding of minerals, rocks, and chemical and physical changes. Final evaluation of the unit can be gained from the transfer activity.

Closure

The trip the Dayton Art Institute and “The Materials of Sculpture Tour” should serve as an application of the knowledge learned in the classroom about rocks and minerals. This activity introduces the students to the uses of rocks and minerals. The Transfer Activity asks the students to apply this knowledge by making decisions about the rocks or minerals they would use for an original sculpture.

Section Three: Art

ALT One: Using Different Media

Summary

In Art class, students will be given an object as the subject matter for their next two art projects. Each student must choose two different media to create a piece of artwork, representing the object. Each student will create one piece of two-dimensional artwork and one piece of three-dimensional artwork.

Competencies

1. Students will demonstrate skill in the use of different media for two dimensional artwork
2. Students will demonstrate skill in the use of different media for three-dimensional artwork.

Time

The full activity will require approximately four hours. Two of the hours should be devoted to the two-dimensional artwork and two of the hours should be devoted to the three dimensional artwork.

Materials

Objects for subject matter (dependent on the teacher)

Choices of materials for two dimensional art (i.e. drawing paper, pencils, pastels, paint, etc.)

Choices of media for three-dimensional art (i.e. Clay, paper mache, cardboard, etc.)

Instructions

1. On the first day allow student to choose an object they feel comfortable recreating using more than one media. Also review all media available to the students.
2. Have students sketch the object on drawing paper.
3. On Day 2 have the students choose a two-dimensional medium to express their object. Using the object and their sketch, have the students create a two-dimensional recreation of their object.
4. On Day 3, have the students select a three-dimensional medium they would like to use to recreate their object. This day could also be used to finish any work on the 2-D art.
5. On Day 4, have the students complete any unfinished work and turn it in for evaluation.

Evaluation/Assessment of Student's Competency

The students' work should be evaluated based on their ability to represent their object in both two and three dimensions.

Closure

Students will discuss with the teacher how the media affected their representation of the object. They should be able to compare and contrast the two media and express a general feeling or mood the media suggests.

Section Three: Art

ALT Two: Creative Expression

Summary

Students will examine several pieces of famous artwork to learn about creative expression. The students will discuss the pieces to come to a consensus about the mood, feeling, themes, and ideas of the pieces. The students will then decide on a mood, feeling, theme or idea they want to create in their artwork. They will then select the appropriate technique and media to express their desired expression.

Competencies

1. Students will select a specific medium to express moods, feelings, themes, or ideas.
2. Students will select a specific process to express moods, feelings, themes, or ideas.

Time

The activity will take approximately 45-60 minutes.

Materials

Prints of famous artwork that expresses different moods, feelings, themes, or ideas
Art supplies for student artwork (i.e. drawing paper, paint, pastels, construction paper, etc.)

Instructions

1. The teacher should present the students with examples of artwork that represents several different moods, feelings, themes, and ideas.
2. The teacher should facilitate a classroom discussion about the artwork, so that the class develops their own definition of mood, feeling, theme, and idea.
3. Each student will need to create a piece of artwork that creatively expresses a mood, feeling, theme, and idea. The student will write out the mood, feeling, theme, and idea on the back of the paper, and create the artistic representation of those expressions on the front of the paper.

Evaluation/Assessment of Student's Competency

The students should be given credit for being able to identify and express their mood, feeling, theme, and idea. The artwork should be evaluated based on what the student identified and the success of creating these expressions with the artwork.

Closure

At the end of this activity, the students should be able to identify the mood, feeling, theme, and idea of a piece of artwork. They should also have an idea of how to use these characteristics to creatively express themselves through art. These skills will be necessary for the transfer activity.

Section Three: Art

ALT Three: Technology in Art

Summary

Students will use computer technology to create original artwork. The students will learn how to use computer software drawing programs to create artwork. They will then be asked to recreate a still-life scene using the drawing programs.

Competency

1. Students will learn how to use computer technology to create original artwork.

Time

The students should be given about 60 minutes to explore and practice the computer program. An additional 40-60 minutes is required to have the students use the computer program to create a still-life drawing.

Materials

Computer lab
Art or drawing software
Objects for a still-life scene

Instructions

1. The teacher should introduce the students to the art or drawing software package.
2. Allow the students time to become familiar with the program. During this time allow the students to have the opportunity to select their own subject matter or object.
3. The teacher should create a still-life scene in the computer lab. It needs to be displayed so that it is visible to all of the students. The scene should have a broad range of three-dimensional objects.
4. The students should spend the remainder of the time making a computer sketch of the still-life scene.
5. The students should save and print the computer sketch and turn it in to the teacher.

Evaluation/Assessment of Student's Competency

Students should be evaluated based on their ability to use the computer software to recreate the still-life scene. The evaluation should consider their mastery of the program as well as their artistic expression of the scene.

Closure

This activity will provide the students with the skills needed to represent three-dimensional objects using computer technology. This skill is necessary for the completion of the Transfer Activity.

Transfer Activity

School Spirit: Designing a School Statue

Summary

The students will design a sculpture or statue for their school. They use the knowledge and skills from the previous Authentic Learning Tasks activities to create a drawing of their sculpture.

Competency

1. Students will identify materials used in sculpture and make decisions of the type material that would best be employed in their sculpture.
2. Students will make a two-dimensional sketch of their design for the school.
3. Students will create a computer generated drawing of the design.
4. Students will learn to present material orally to classmates, using clarity and description.

Time

Two to three hours are needed to complete this activity.

Materials

Drawing paper
Computer lab
Computer software drawing program
Computer printer

Instructions

1. Teacher will present the assignment to create a sculpture and statue design for the school.
2. Students will make drawing or sketches of the design on paper.
3. Students will select a media material (rock, mineral, metal) that would best accommodate their piece of work, and defend the choice of material that could be used.
4. Using the computer software the students will use the computer and art skills to create their design.
5. Completed designs will be saved and printed, then used as a display of school pride.

6. Students will write a descriptive one page paper about their artwork. The choice of material, the mood, feeling or theme of the piece, and the proposed size and dimensions are to be included.

Students will make an oral presentation using their computer artwork as a visual display.

Evaluation/Assessment of Student's Competency

Students' computer skills with the software will be evaluated for behavior and technique. Their computer artwork will be assessed as to the neatness and clarity of the design. Their written explanation will be graded on writing technique, and also the scientific reasoning for the use of materials they propose to be used in the creation of the piece.

Closure

The students will have the opportunity to display their designs and make an oral presentation about their work. This transfer activity will allow for discussion of math, science and art skills that they have learned and used.