

Burnt Earth: The Science of Ceramics

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Overview:

Burnt Earth: The Science of Ceramics with an emphasis upon science that is specifically designed for gifted middle school students. The goal of the curriculum is to have the student realize that there is an essential scientific basis for many art projects and activities. This is especially true of ceramics. I have expanded my ceramics curriculum to include some of the everyday applications of scientific principles to artistic expression. The curriculum is three pronged. It first addresses the historical and cultural relevance of ceramics. Next, it challenges the students to do research on the scientific aspects of ceramics. It then suggests studio activities that allow them to use what they have learned. These activities include working with clay to make sculpture and pottery as well as designing signage to illustrate the science of ceramics.

Rationale:

Currently, I teach Fine Arts to seventh and eighth grade students at Pittsburgh Gifted Center. The mission of this center is to provide gifted education to students from kindergarten to eighth grade who are enrolled in the Pittsburgh School District. Private and parochial school students also are eligible to attend, and there are a few tuition students. I am the only art teacher and provide instruction to students eager to express themselves creatively.

The Pittsburgh Elementary Gifted Center and the Pittsburgh Middle Gifted Center were combined in the 2001-2002 school year. The combined school, The Pittsburgh Gifted Center, is in the process of developing a seamless kindergarten through eighth grade program. It prepares the gifted students for high school CAS (Centers for Academic Studies) program by offering enrichment courses in a variety of subjects.

The students select four courses each September and January. The courses are teacher designed and consist of fifteen one-hour classes. The seventh and eighth grade students are offered courses in the fine arts, language arts, the sciences, mathematics, social studies, and technology. Because the courses are teacher designed and because one of the objectives of the program is enrichment, I have the luxury of tailoring my curriculum to the individual needs of my students. In the 2001-2002 school year I offered courses in sculpture, drawing and painting, textiles and Papier-mâché Aliens.

One of the needs of the students came to my attention when I was teaching a course in sculpture. The unit on ceramics posed many questions. The students often asked "Why does clay get hard in the kiln when it is fired?" They were not satisfied with the usual answer; "It is a chemical reaction." They pressed for more detailed information. We began looking into the matter by reading the Amaco catalogue. The Amaco Company is one of the main suppliers of ceramics for the art room. As we read through the catalogue and checked out the Amaco web site, many of the students showed more than a passing interest in the science behind the processes. The students showed an interest in the glazes. They asked about lead content. They were curious about the colors. They wondered how they were mixed. The answers to these questions led to more questions.

When I read the description for the seminar, "Everyday Science" led by Dr. Stocks, I thought that the seminar offered an opportunity to develop a curriculum that would address the scientific aspects of ceramics. The ceramic artist is not regarded as scientist yet a solid understanding of the properties of clay is essential if the artist wants to achieve a desired result. The curriculum, "Burnt Earth: The Science of Ceramics" provides an opportunity in the art room for students and their parents to gain a broader appreciation of science and of themselves as scientists as well as artists.

The seminar has given me the opportunity to investigate and to marvel at what the future holds in the field of ceramics and material science. Dr. Stocks structured the seminar, Everyday Science, to address the needs of all the members of the seminar by inviting guest speakers to present in their areas of expertise. In order to help me investigate the field of ceramics, she invited Paul Salvador, a ceramics engineer from Carnegie Mellon University's Department of Material Science, to speak to the seminar. He began by saying prehistoric man discovered that clay left in the fire became hard. The Greeks called ceramics "burnt earth". They referred to pottery as "burnt stuff". He then spoke of the everyday uses of ceramics as well as some of the projects he is currently pursuing for Carnegie Mellon University. He spoke with great enthusiasm as we marveled at what he told us. He spoke of structural ceramics, (sewer pipes and bricks) whitewares, (dinnerware) refractories (energy conservation and conversion) glasses (windows and containers) abrasives (diamonds) cements, advanced ceramics, biomedical uses in bone replacement, aerospace, electrical conductors. It was mind-boggling. He emphasized that ceramics are an integral part of our lives but many of the uses go unnoticed. He suggested that I visit the American Ceramics Society's web site for more information. I did. I found it extremely helpful. They have extensive information for educators. This curriculum to a great extent relies on this information provided by the American Ceramics Society

This curriculum will address the Art & Humanities Content Standards: 3. All students relate various works from the visual and performing arts and literature to the historical and cultural context within which they were created. 4. All students produce, perform, or exhibit their work in the visual arts, music, dance or theater and describe the meaning their work has for them.

Objectives:

The student and their parents will gain a broader appreciation of science and for themselves as scientists as well as artists by learning the scientific processes that take place in the creation of a piece of sculpture or a piece of pottery from clay.

The student will also become aware of the history of ceramics.

The student will become aware of the intricate part ceramics has played in the development of civilization by looking at slides, posters, videos and artifacts.

The student will list the many uses of ceramics in everyday life then create a display of ceramic artifacts that are utilitarian in nature.

The students will create pottery and ceramic artwork as well as look at pieces of pottery and ceramic artwork created by others.

The student will discover the importance of ceramics in the development of the future by researching the use of advanced ceramics in the space program, in medicine, and technology.

The students will be challenged to create signage that explains one of the facts he/she has learned about the science of ceramics.

Strategies:

In order to present such a broad subject in fifteen one-hour classes and still have time for studio work I had to look for videos, visuals and guest speakers that would give a lot of information in a short amount of time. I tried to find amazing facts about ceramics. I tried to find unusual images the students would remember. I looked for information to spark their curiosity. I expect the students to contribute to the class by bringing in articles. They may even suggest guest speakers or field trips.

Strategies to motivate the ceramics class.

Ceramics is a popular class. Motivation is never very difficult. It is, however, necessary to find an appropriate starting point. The students have many and varied experiences working with clay. Often the experiences the students have had are limited to a specific area of ceramics. In order to assess what

kinds of experiences the students have had, I start by asking questions. " What do you know about ceramics and pottery?" "What is clay?" " Have you worked with clay in elementary school?" "Have you attended ceramics classes in an after school or summer programs?" " Do you have a relative who is interested in ceramics?" Once we establish what the class knows about ceramics, the class will view videos, slides, timelines, charts, and filmstrips in order to broaden their horizons. We will check out web sites. We will interact with guest speakers and take field trips to local ceramics studios. We will look at actual pieces of ceramics. The students will create a display of ceramic art and everyday objects.

Strategies for teaching the history of ceramics.

The history of ceramics starts at the very beginning of time. I want the students to know that clay is mud. Clay is part of the earth's crust. Clay was here long before people walked on the earth. Before people wove clothing to wear, they made vessels from clay. It has played a major role in the development of mankind. Much of what archeologist tell us about the past is gathered from shards of pottery. Clay tablets were used for writing. Pottery was used as vessels. The Egyptians developed glazes in order to prevent the their porous clay pots from leaking. The Etruscans even developed a glaze that modern man has yet to duplicate. The decoration on tiles and pots tell of heroes and villains. From pottery we learn something of our earliest dreams and adventures. Art historians are only now appreciating the artistic and scientific sophistication of early man through the tracks and traces left by early man on pieces of ceramics. The Ceramics Timeline, is a starting point.

It highlights clay from 35,000 BC to present. I have selected from [Art&Man: Artists of the Ice Age: Working with Sculpture](#) the articles, [The First People](#) and [Ancient Animals](#) to introduce early man and cave art. The articles include art and artifacts made from clay but not fired. The articles compare the strong sense of design found in these pieces with the works of twentieth century artists. The articles introduce the design terms, simplifying and stylization. There are pictures of sculptures and jewelry that reveal early man was quite skilled at modeling and incising. The elements of art, of positive and negative shape, texture, line quality are evident in the examples of art shown in this article.

Strategies for teaching ceramics now and into the future.

Many of the things we use everyday are made from clay. I think the students would enjoy discovering the ceramic objects in the building- everything from bricks to tiles to sinks to dishes. It would be fun to make signage to identify ceramic objects in the school building. I can visualize signs in the bathrooms, above the water fountain, on the bricks and tile walls and floors explaining the objects that are made from clay.

The American Ceramics Society provides a [Ceramics Media Tip Sheet](#) on their web site. It includes: "A dozen fascinating story ideas about one basic fascinating material-ceramics. Science, human interest, sports, business, medicine- they are all in this special Media Tip Sheet brought to you by the American Ceramic Society(AcerS)" The titles of the Articles are: The Ceramic Astronaut, Cancer Fighting Glass, Radioactive Remedy, Tough as Glass, Outsmarting the Slopes, Marine Marvels, Remarkable

Replacements. Space Shuttle Secrets, Amazing Engines, White House Ware, The Ceramic Web, Hot Careers, Cool Stuff. All of these articles are interesting but the best part is the help the American Ceramic Society is willing to give to the students. The top of the Ceramics Media Tip Sheet reads: "We have the resources to help you bring any of these suggested story ideas to fruition, We'll help you line up interviews, obtain photos, get background information and whatever else you need. Simply contact AcerS headquarters at 614/794-5885 or communications@acers.org. We will make sure you get what you need."

Strategies for teaching signage.

Signage adds another layer of problem solving to the curriculum. The students will have to have a clear understanding of the subject in order to create signage. Dr. Janet Stocks arranged for The Kennywood Roller Coaster Sign Project presentation will take the class through the design problem solving process. The CMU students discuss: "Who is my audience?" "How much information should I give them?" "How should I present it?" "Is the intended audience responding to the signage?" The ceramics students will answer the same questions. The signage that they design will be a success if the intended audience responds to the signage by learning some thing about the everyday science of ceramics.

Strategies for teaching ceramics construction techniques.

The best way to learn how to work with clay is a teacher demonstrating the procedures, guided practice with student and teacher working together and independent work. There are posters and videos available. They are excellent resources. The Ceramic Poster Set includes fourteen posters. The fourteen posters include wedging, pinch pots, coil construction, slab construction, hump molds, centering and throwing, trimming, profiles of pots, glazing, and bisque firing.

Art is Video Series is available from Crystal Productions. This Series, Throwing Series and Handbuilding Series is part of the series but these tapes can be purchased separately.

The Ceramics Poster Set is also available from Crystal Productions.

The visuals reinforce the teacher's demonstration.

Questions and Answers to Accompany the Teacher's Demonstration.

What is clay? Where did it come from?

I buy clay in fifty pound boxes. It comes in two twenty five-pound bags. It is the consistency of Velveeta cheese. It is very processed. When I ask the students "What is clay" Where does it come from?" most of the students do not have a clue. When I tell them that it is mud I get a group response of "NAHH!" I found a scientific answer in "Claywork, Form and Idea in Ceramic Design by Leon I Nigrosh second edition on page 13, "The earth was once a mass of molten material. As the planet cooled, the heavier materials began to settle into relatively distinct layers. The surface layer formed by this cooling is made

up of what is known as an igneous rock. This cold molten rock is made up of almost 69 percent silica and about 15 percent alumina, both important elements in the ceramics process. Eons ago, water, wind, and ice and the expansion and contraction of the planet began to pulverize the rock, depositing silica and alumina particles along with other minerals and organic materials all over the globe. The resulting conglomerate is clay."

In order to work with clay, the student must remove all the air bubbles by wedging the clay. Wedging the clay is similar to making a pizza. The clay is pounded and kneaded until it is a smooth lump. This is very important because air bubbles will cause the clay piece to break during firing in the kiln.

What is a pinch pot?

A pinch pot is a container that is made by first rolling the clay into a ball, then inserting your thumbs into the center to open the pot. The clay is turned and pinched to form a pot. The sides should be about one quarter inch thick. This will prevent it from breaking during firing in the kiln.

What is the coil technique?

The students refer to the coil technique as "making a snake" from clay. The coil is made by rolling the clay on a flat surface with both hands. The coil is wrapped around a flat clay base. The form is built up by adding coils. The resulting form can be left as is or smoothed. This sounds a lot easier than it is. It takes a lot of practice. The pots can be quite elaborate.

What is slab construction?

Slab construction is the process of rolling out sheets of clay with a rolling pin, cutting out shapes from the sheets, then joining the shapes by scoring and attaching the pieces with slip.

What is a hump mold?

A sheet of clay is draped over a built-up form. The result is either a concave or convex form.

What do the terms throwing and centering refer to?

The techniques throwing and centering refer to the technique of creating a pot on a potter's wheel. Centering refers to the fact that the clay has to be in the exact center of the wheel for the potter to be able to form a pot. It works on the principle of centrifugal force.

What is a kiln?

A kiln is a high temperature oven used to fire clay.

What chemical changes take place during firing?

This question arises when I tell the students that their pieces must sit and dry out for a week or two before it is fired. Then I explain that the firing will take all day and the cooling will take all night. This particular group of students grew up with microwave ovens. The possibility that something has to be in the oven all day and all night is amazing to them. I created a chart to be displayed by the kiln. The students can then look at the temperature displayed on the kiln, refer to the chart and know where we are in the firing process. This is very detailed,

" The earliest of these changes is about 100 C (212 F) when the atmospheric moisture leaves the ware in the form of steam. If this temperature is reached too quickly, the clay will explode. Silica undergoes its first chemical change from alpha cristobalite to beta cristobalite at about 220 to 275 C (428 to 557 F) Water smoking or evaporation of chemically combined water from the clay occurs from 450 to 600 C (842-1112 F). Considerable abrupt shrinkage takes place at this time as kaolinite changes to metakaolin. Therefore, the temperature rise should be gradual to keep the ware from splitting. Silica changes again around 635 C (1063 F) from alpha to beta quartz. By 700 C (122 F) all organic and inorganic compounds such as carbon and carbonates have become decomposed or oxidized. At 870 C (1598 F) silica changes once more, this time into its tridymite formation. Another major and sudden shrinkage takes place at 950 to 980 C (1742 to 1796 F) when the metakaolin changes to spinil. From 1050 to 1100 C (1922 to 2012 F) mullite crystals begin to grow though the combination of alumina and silica, giving the clay its strength. As the temperature continues to rise, more silica forms a glass around the mullite crystal, increasing the hardness of the clay. While the glassy phase continues, further shrinkage takes place at 1200 C (2192 F) when the silica changes to a more complete form of cristobalite.

Impurities and varied composition control the extent of the maturation in clay bodies. Iron loaded earthenware clays mature, that is, reach their highest point of favorable vitrification, at about 1090 C (1994 F). While most stoneware mature at 1290 C (2354 F), and pure kaolins mature at about 1650 C (3002 F) or higher." (Claywork Form and Idea in Ceramic Design Second Edition Leon I. Nigrosh Davis Publication, Inc., Worcester, Massachusetts 1986 ISBN 0-87192-173-1) Page 171

What is a glaze?

A glaze is essentially a thin layer of glass covering the pottery article. Its purpose is practical, since a glazed pot is waterproof and easier to clean also aesthetic insofar that a glaze may enhance the appearance of a pot. Fransworth, Warren. Beginning Pottery. New York, New York. Van Nostrand Reinhold Company 1973 page 123

Classroom Activities

Lesson: 1

History: Prehistoric

Science: *What is clay?*

Studio: *Cave Art-Pinch Pots/ Animals*

Objective:

The student will read about prehistoric man, discuss the art and science involved in prehistoric man's lifestyle then create a clay sculpture that is inspired by prehistoric art.

Materials: Clay, clay tools, oilcloth, water jars, plastic bags and twistees, masking tape

Resources: Art and Man, "Artists of the Ice Age, working with Sculpture" January, 1988

Large prints of the Paintings on the Cave Walls at Lascaux, France. (Available from Sherwood Visuals)

Vocabulary: pinch, score, texture, fire, kiln, bisque, bone dry

Motivation and Guided Exploration: Art and Man, "Artist of the ice Age" asks the question "What might it have been like to live at the very beginning of human life?" What we know about prehistoric people comes from the artworks they left in caves. Large paintings of animals, jewelry, unfired clay sculptures, a handprint on the wall. They used the materials at hand to create their art. Clay that was loaded with elements such as iron was used as paint. Often a bulge in the wall was the basic form of a three dimensional animal painting. The magazine has a picture of two clay bison. The art is representational. It consists of powerful stylized forms. It could be mistaken for twenty-first century art. A great deal of their artwork is based on animals. We can only ask why. We find animal drawings and designs in many cultures. The handprint that was created by blowing clay through a hollow bone over a hand pressed against the wall of the cave is most compelling. It seems to say, "I was here!" All the ceramic sculpture that the students create will say the same thing to people who come after us and find our artwork. We were here!

The ceramic bison were not fired. It is amazing that the bison lasted as unfired clay can return to mud if it gets wet. The work we do in the art room will be fired in the kiln. A chemical change takes place during firing. The fired piece will not turn into mud if they get wet.

Studio: Challenge the student to plan, design and create a clay sculpture of an animal.

Method: The teacher will precut the twenty five pound lump of clay into one pound pieces. The teacher will demonstrate how to wedge the clay in order to remove the air bubble. The students will wedge and knead the clay until it feels like a cohesive lump of clay. The students will be instructed to push and

pull the clay into the desired shape. It is easier to model the clay from one lump than to attach pieces to the main piece. The teacher will demonstrate how to attach pieces of clay to one another by scoring both pieces and using slip to seal the seams. I compare the scoring process to Velcro. Both sides must grip in order to form a seamless bond.

Lesson: 2

History: Greece

Science: Symmetry

Studio: Coiled pot

Resources: Posters and slides of Greek Pottery

Objectives:

The students will be able to distinguish Greek pottery from other types of pottery.

The students will be able to discuss the significance of painting in the Greek culture then relate it to vase painting.

The student will be able to discuss the development of vase painting.

The students will be able to list the types of Greek pottery.

The student will be able to discuss the concept of symmetry and then relate it to Greek pottery.

The student will know that the Greeks developed specific containers for specific purposes.

The student will understand the technique of slip decoration and sgraffito.

Materials:

White drawing paper, pencils, cardboard, scissors, clay, plastic bags, masking tape, clay tools, water jars

Science:

Require the students to point out examples of symmetry in nature.

Studio:

Challenge the students to create a coiled clay vessel using a cardboard template to create a symmetric form. The students may decorate the pot in the manner of the Greeks by either using geometric designs or figures. The design should fit the shape of the pot.

Method: Demonstrate the coil method. Demonstrate how to cut out a template from cardboard and then use it for a guide.

Assessment:

Require the student to complete a Portfolio Entry Sheet

Lesson: 3

History: China: The Chinese Emperor's Pottery Army

Science: Archeology

Studio: Portrait in Clay

Resources: Scholastic Art: Chinese Art Working with Sculpture February 1993 Vol. 23, No. 4. ISBN 1060-832xPublished in cooperation with the National Gallery of Art. Formerly Art & Man

Objective:

The student will read about China then learn of an amazing archeological find in China, An Army from the Past.

Method: The class will read the first article in the magazine, Ancient Symbols. " Unlike most cultures, the Chinese have maintained their land and ways for centuries. Looking at Chinese art means learning to see changes within this long continuity." The class will get into groups of four to discuss the article. The discussion should include "What does the Great Wall tell you about China's values? Is realism important in Chinese art? How do the Chinese show the essence of a subject in their art? Does the article indicate what was happening in the rest of the world during the time China was building the Great Wall?

The second article, Harmony with Nature, tells how animals are represented in Chinese art. "Early Chinese animal sculptures were believed to have magical qualities." The class will be divided into groups of four. The students will read the article then discuss what they have read. They will then present the information to the class. The point should be made that these sculptures were cast in bronze. The process of working in clay then casting in bronze will be discussed in great detail at a later time.

The third article, An Army from the Past, tells of a magnificent archeological find in the spring of 1974. " Some workers were digging for a well near the tomb of Shih Huang Ti, the Ch'in Dynasty emperor who unified China and built the Great Wall. They came upon an amazing sight-as they dug, a

huge underground vault appeared beneath them. At the bottom, hundreds of figures of men, horses, and chariots, all life-sized, seemed to be climbing up out of the reddish soil in which they had been buried long ago.” There are pictures accompanying this article and a diagram that gives some idea of the vastness of this sight. Archeologists have a theory about why all the figures are different. “We believe the emperor ordered the artists to model realistic portraits of each warriors so the same soldiers could continue to guard him after death.”

Studio: The art you have seen in this magazine had spiritual significance to the artist who created them and to the emperor who ordered them. In this studio activity you will create a sculpture from terra cotta clay. The sculpture should be of an animal that has some spiritual significance to you. It may be of a pet or it could be of a universal animal symbol.

Draw three thumbnail sketches of the animal that you have in mind for this project. Decide if you would like to create a realistic sculpture or a stylized piece. When you are ready to begin working with clay choose a piece of clay as big as your fist. Wedge the clay to remove the air bubbles. Hold the clay in your hand and knead it. Begin working the clay by pulling and shaping it into arms and legs. It is easier to pull the parts out of the main body of clay than it is to attach them to the body. Your fingers are the best tools for shaping and smoothing the piece. If you choose to add designs and symbols to the piece as the Chinese did, you may use the clay tools or invent your own tools. If time runs out before you are finished with your sculpture, place the piece in a plastic bag with a moist paper towel. Fasten the opening with a rubber band so that it is airtight. Put your name on the bag by first writing your name on a piece of masking tape. Place on the shelf until next class. If you have completed your sculpture, allow it to air dry. It will take approximately two weeks to get it bone dry. When it is dry we will bisque fire it in the kiln.

Lesson: 4

History: Rodin

Science: Casting in Bronze

Studio: Sculpture Figure

Resources: Rodin, Video available from Crystal Publications, Art and Man. Auguste Rodin, Working with Sculpture. New York, New York: Scholastic, Inc., November, 1990

Meet a Working Sculptor, Martine Vaugel available from American Schools Publishers Macmillan/MacGraw-Hill 1992 This program takes the viewers into Martine Vaugel's studio where they see a full figure bronze sculpture created. Each step of the sculpting process is presented in detail. ISBN 0-383-048176-6

Evert, Marilyn. Discovering Pittsburgh's Sculpture. London: Feffer and Simons, Inc. University of Pittsburgh Press, 1982

Objective:

The student will view the video "Rodin" then read the magazine "Art and Man, Auguste Rodin, Working with Clay" in order to gain biographical and historical information about the 19th century French artist, Auguste Rodin.

The students will view the video "Meet a Working Sculptor, Martine Vaugel" in order to observe the process of bronze casting.

Method: Auguste Rodin was a 19th century French artist. He lived through the Franco Prussian War. He worked during the time when The French Impressionist Painters were challenging the Academie. He created public art. Much of his work was ridiculed. His sculpture, the Thinker, has become an icon. I am sure the students have seen the Thinker on t-shirts, in commercials and in comic strips. Rodin's life and times offers many starting points for discussion. "What was the Academie?" "Why were the French Impressionist challenging the Academie?" "Why was Rodin's work ridiculed?" "Why is it considered a masterpiece today?" The magazine and the video offer insights to these questions. The students will have their own opinions after viewing Rodin's works.

The city of Pittsburgh has many public sculptures. Many of them are cast in bronze. Although it may not be possible for our class to cast a sculpture in bronze, I would like the students to be aware of the process. Viewing the video Meet a Working Sculptor, Martine Vaugel will give the viewer a complete look at the process.

Studio:

Challenge the student to create a clay sculpture of a figure that depicts an emotion in the manner of Rodin.

Ask the students to bring in photographs of public sculptures that are located in their neighborhoods.

Assessment: Require the student to complete a Portfolio Entry Sheet.

Lesson: 5

History: Ceramics: Now and Into the Future

Science: Advanced Ceramics

Resources Ceramics into the Future Videotape available from the American Ceramic Society. <http://www.ceramics.org> Tip Sheet. <http://www.scitechdaily.com/>

Objective:

The students will identify ceramic ware that they use every day.

The student will research the future of ceramics by choosing a topic from the Tip Sheet.

The student will be able to list some uses of advanced ceramics.

Studio: Create a display of articles and artifacts that correspond to the research. The display may include artifacts and or photographs.

Decorate a ceramic bisqueware tile with underglaze and glaze. This will be an interdisciplinary activity with the elementary science classes and the middle school fine arts classes.

Lesson: 6

History Students Choice

Science Students Choice

Resources:

Students from Carnegie Mellon who participated in the Kennywood Roller Coaster Signage Project will be invited to give a presentation on the design process. They documented their work. Their presentation gives a clear complete explanation of what is involved in creating a sign that is attractive, informative and accessible to its audience.

Objectives:

The student will be able to identify and discuss past, present and future uses of ceramics.

Studio:

Require the student to plan, design and construct signage that conveys information about ceramics.

Instruct the student to list possible topics on the board.

Have the student refer to the list on the American Ceramics Society's web site.

Encourage the student to use Power Point to create a slide show to illustrate information on ceramics.

Assessment

Exhibit of artifacts and Power Point Story boards

Signage around the building

Annotated Bibliography/Resources

Teacher and Student Bibliography

Evert, Marilyn. Discovering Pittsburgh's Sculpture. London: Feffer and Simons, Inc. University of Pittsburgh Press, 1982

The students enjoy looking through this book because they recognize the sculptures.

Farnworth, Warren. Beginning Pottery. New York: Van Nostrand Reinhold Company, 1873

A wonderful little book!

Mittler, Gene. Art in Focus. Peoria, Illinois: Bennett & McKnight Publishing Company, 1986

This is an excellent resource that includes studio activities.

Nelson, Glenn C. Ceramics. New York: Rinehart and Winston, Inc., 1960

A basic handbook and good resource for the art teacher.

Nigrosh, Leon I. Claywork: Form and Idea in Ceramic Design. Worcester, Massachusetts: Davis Publication, Inc., 1986 (ISBN 0-87192-173-1) Page 171

This book has very technical information

Magazines

Art and Man. Artists of the Ice Age, Working with Sculpture. New York, New York: Scholastic, Inc., December, 1987

Art and Man. Auguste Rodin, Working with Sculpture. New York, New York: Scholastic, Inc., November, 1990

Resources: to motivate the ceramics class.

American Craft Museum Slides (SS-1794 set of 9 slide packets. Available from www.crystalproductions.com) Includes Hollowware from the Permanent Collection, The Object as a Vessel, The Object Made for Use, The Object as Statement, The Object as Personal Adornment, Animal Imagery Ceramics, Troupe L'Oreal ceramics, Political Ceramics: Social Issues, Political Ceramics; War. The complete set can be purchased or sets may be purchased individually. The sets come with a teacher's guide.

Contemporary Ceramic and Ceramics Prints is available from Crystal Productions. This is an economical way to introduce the unit.

Videos

Visuals

Ceramics Timeline and Teacher's Guide

"From writing surfaces to spaceship shield these illustrated timelines trace the role of ceramics throughout human history." Available from Dick Blick Art Materials

Ceramics Video and Portfolio of Prints, Art Smart Pottery Set of 4 Videos, American Craft Museum Videos and Slide Sets.

Ceramics Posters and Video Set. Available from Crystal Publications-www.crystalproductions.com

Resources: teaching the history of ceramics

Ceramics Innovations Timeline and the accompanying set of slides; Ceramics Innovations Timeline Slide Set. Both resources may be purchased from Crystal Productions. The presentation and ensuing discussion will give the students an overview of the breath and scope of ceramics in human history. "From writing surfaces to spaceship shields, these illustrated timelines trace the role of ceramics throughout human history,

By reviewing the images and timeline text students discover the contribution of ceramics in visual arts, writing, history, geography, economics and science from 35,000 BC to the present"

Lascaux Revisited-Exploring Cave Art is available from Crystal Productions. This set is a wonderful way to introduce prehistoric art.

Art and Man, "Artists of the Ice Age, working with Sculpture" January, 1988

Large prints of the Paintings on the Cave Walls at Lascaux, France. (Available from Sherwood Visuals)

Resources:

The American Ceramics Society

P.O. Box 6136 Westerville, Ohio 43086-6136 614-890-4700 614-899-6109 FAX

Tip Sheet available on www.ceramics.org

Pottery: Vessels of Time Associated Glass & Pottery Manufactures Video and Teacher's Guide available free of charge on The American Ceramics Society's web site www.ceramics.org

The American Ceramic Society Book Catalog. Where Art and Science Meet

Discovering Material Science and Engineering, Cornell University web site, www.mse.cccornell.edu/materials_science_discovering/

Ceramics into the Future Videotape available from the American Ceramic Society

Science News Daily web site,

Web sites

<http://www.ceramics.org>

American Ceramics Society

<http://www.scitechdaily.com/>

SciTech Daily Review reviews articles on science, technology, future developments, innovations and implications.

Appendices

Materials for classroom use:

Clay

Kiln

Table coverings- oilcloth, burlap

Clay Tools

Plastic Bags & Twistees

Masking Tape

Kiln

Glazes

Underglazes

Brushes

Water Jars

Plastic Garbage Can with Lid

Assorted objects for Making Texture in Clay

Brushes

Rolling Pins

Wood strips

Wire

Portfolio Entry

Arts & Humanities

Student Name _____ School _____ Day _____

What content standard are you addressing?

What was the objective of this project/lesson?

What procedure did you use?

How would you assess your work and what rubric would you give yourself?

Standards

Arts & Humanities content Standards.

1. All students describe meanings they find in various works from the visual and performing arts and literature on the bases of aesthetic understanding of the art form.
2. All students evaluate and respond critically to works from the visual and performing arts and literature of various individuals and the cultures, showing that they understand important features of the works.
3. All students relate various works from the visual and performing arts and literature to the historical and cultural context within which they were created.
4. All students produce, perform, or exhibit their work in the visual arts, music, dance or theater, and describe the meaning their work has for them,