

Grade Level: 8th Grade

(In my current district middle school this would be feasible as our students are advanced in Science. We have the advanced honors students at my building) This could be bumped up to high school level and be co-taught with the high school ceramics teacher(s) and science teacher(s). This might also be a unit best taught in the spring or fall depending on the type of winters of the local area there are. i.e. Chicago is too cold and frozen to do this in the winter time)

Time Frame: 11-12 days of 45-50 minute class periods including 1 full day field trip.

Brief Description of Lesson: This is a series of lessons comprised to integrate Science, History and Art together in a sequences of interrelated learning activities.

Day 1: Weathering and Erosion: Mechanical and Chemical Weathering Introduction (Steel Wool Lab which requires 3-4 days between day 1 and days 2-3 of the lab)

Day 2: Field Trip to River Bank and Clay Collection

Days 3 and 4: Types of Clay Formulas and Refining of Clay Sample from Field Trip

Days 5 and 6: Continuation of Weathering and Erosion (day 1) Steel Wool Lab and Sugar Cube Lab

Days 7-11: Artistic Investigation of the Properties of Clay (from the field trip) and using the Design Process to formulate a 3D object (functional or decorative) that represents a historical or modern day culture.

The integration of these lessons takes the learning about weathering and erosion through hands on learning experiences. Students can see first-hand the cause and effect of weathering and erosion through the field trip experiences. The clay experiences of the unit tie in historical uses of clay, practical application of clay and also aesthetic(decorative) application of clay through design and creating their own project in clay refined from the field trip experience in addition to using clay purchases pre-refined by a company. These learning experiences integrate the weathering and erosion in science, the historical uses of clay, the design process and product-based learning through making a form in clay and then observing the changes to clay as it is heated in the kiln. Without weathering and erosion, and the development of the use of clay over time, we would not have the documentation of cultures that we do today (ie. knowledge about ancient civilizations). This lesson is an adaptation and extension of the lesson Weathering and Erosion 6.1 Mechanical and Chemical Weathering from Science Matters for lesson days 1, 5 and 6.

(<http://sbsciencematters.com/lesson-units/6th-grade/6th-earth-science-weathering-erosion/>).

Specific Learning Outcomes:

Students can predict and make observations through data collection of the weathering process.

Students can interpret and categorize information based on a collection of data from

experiments.

Students can make predictions and hypothesize what might occur in an investigation. Students can explain phenomena in terms of concepts. (ie. chemical/mechanical weathering, erosion, ecosystems, minerals, sedimentation)

Students can draw conclusions from observations and investigations supported with evidence.

Students can connect and apply science concepts (weathering/erosion, sedimentation, ecosystems, physics and chemistry) and historical influences on art making with clay.

Students can design and create a project out of clay and apply concepts (applying force to roll and form clay, evaporation of water from clays through its exposure to the air, the properties of clay change after the kiln firing process) through the creative process.

Narrative/Background Information:

Prior Student Knowledge: Prior to this lesson students would have an understanding of the history of planet Earth such as rock strata and fossil records. Students will also have an understanding of energy flows, plate tectonics and volcanic activity and phenomena. Students will also have an understanding of ecosystems and sedimentation. Students will also have knowledge of chemical reactions prior to this lesson.

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| <p>Science & Engineering Practices:</p> <ul style="list-style-type: none"> ● Developing and Using Models ● Planning and Carrying Out Investigations ● Analyze and Interpret Data ● Constructing Explanations and Designing Solutions ● Obtaining, Evaluating, and Communicating Information | <p>Disciplinary Core Ideas:</p> <p>PS1.A: Structures and Properties of Matter PS1.B Chemical Reactions PS3.A: Definitions of Energy ESS2.A: Earth’s Materials and Systems ESS2.C: The Roles of Water in Earth’s Surface Processes ESS2:D Weather and Climate ESS3.A: Natural Resources</p> | <p>Crosscutting Concepts:</p> <ul style="list-style-type: none"> ● Patterns ● Cause and Effect ● Scale Proportion and Quantity ● Systems and System Models ● Energy and Matter ● Stability and Change ● Structure and Function <p>Connections to Engineering, Technology and Applications of Science</p> <ul style="list-style-type: none"> ● The uses of technologies and any limitations on their use are driven |
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| | | <p>by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural explanations.</p> <p>Influence of Science, Engineering, and Technology on Society and the Natural World</p> <ul style="list-style-type: none"> • All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. |
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Possible Preconceptions/Misconceptions: Students may have the preconception or misconception that clay is a manmade material. Students may believe that the Earth is unchanging and that it does not change over time. Some may believe that erosion happens quickly and that all erosion is bad. The link below discusses in depth more preconceptions/misconceptions that students may have about weathering and erosion.

<https://beyondpenguins.ehe.osu.edu/issue/earths-changing-surface/common-misconceptions-about-weathering-erosion-volcanoes-and-earthquakes>

NGSS Science and Engineering Standards

MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth’s mineral, energy and groundwater resources are the result of past and current geoscience processes.

MS-PS1-2 Analyze and interpret data on the properties of substances before and after they substances interact to determine if a chemical reaction has occurred.

MS-ETS1-3 Engineering Design: Analyze data from tests to determine similarities among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

CCSS ELA and Math Standards:

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the specific details of explanations or descriptions.

RST/6-8.1 Follow precisely a multistep procedure when carrying out experiments, taking measurements or performing technical tasks.

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (ie, flowchart, diagram, model, graph or table).

WHST.6-8.7 Conduct short research projects to answer a questions, drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

WHST.6-8.8 Gather relevant information from multiple print and digital sources, using searchterms effectively, assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusion of others while avoiding plagiarism and following a standard format for citation.

MP.2 Reason abstractly.

MP.4 Model with mathematics.

Illinois Visual Arts Standards:

VA:Cr1.1.8 a. Document early stages of the creative process visually or verbally in traditional or new media.

VA:Cr2.1.8 a. Demonstrate willingness to experiment, innovate, and take risks to pursue ideas, forms, and meanings that emerge in the process of art making or designing.

VA:Pr6.1.8 a. Analyze why and how an exhibition or collection may influence ideas, beliefs and experiences.

VA:Re7.1.8 a. Explain how a person's aesthetic choices are influenced by culture and environment and impact the visual image that one conveys to others.

VA:Re8.1.8 a Collaboratively develop meaningful interpretations, supported by evidence, of artworks through describing and analyzing feelings, subject matter, formal characteristics, art-making approaches, contextual information, and key concepts.

LESSON PLAN 5E Model Day 1 Topic: Weathering and Erosion: Mechanical and Chemical Weathering

Engage: Opening Activity-Access Prior Learning/Stimulate Interest/Generate Questions: (15 minutes) Physical and chemical weathering changes the earth.

1. [Use Pear Deck and share slide deck](#) with students. The first slide will have two

columns, one labeled Chemical Weathering and the other Physical Weathering, ask students to Think-Pair-Share what they know (KWL) about chemical and physical weathering of the Earth using the slides.

2. The next slide is a survey where students will draw a line to connect which item on the list is either chemical or physical weathering. Another alternative is providing a link to a Google Form. The survey should be completed individually and their responses will be confirmed during the slide deck on Weathering.
3. Distribute 2 lifesavers per student. Ask students to suck and chew on the a Lifesaver to see the difference between the two types of weathering. Discuss which model might represent mechanical weathering and which one might represent chemical weathering? How do you know?
4. Ask students to think Think-Pair-Share and write their responses about these two types of weathering they simulated by sucking and chewing on the Lifesavers. During this process they should be citing evidence and give explanations using specific scientific and technical details. Complete slide for the Weathering Survey Part 2 slide.

Explore/Explain #1: (15 minutes) Different types of physical and chemical weathering change the surface of the Earth.

5. Show students the slide deck on weathering.
6. Discuss the images showing different types of mechanical and chemical weathering. Correct responses on the weathering survey using a different color text.
7. Ask students to suggest additional entries on the Chemical and Physical weathering chart (KWL) in step 1.

Explore/Explain #2: (15 minutes) Chemical weathering breaks rock by interactions between air, water and rock materials.

8. Explain to students that we can explore the effect of chemical weathering through observing what happens to steel wool when it is exposed to water and air. Distribute supplies to students to create their “dry” and “wet” bag for the Steel Wool Lab.
9. Ask students to label one bag “dry” and put one small piece of wool in that bag. Ask students to label the other bag “wet”. Each group should wet the other piece of steel wool and put it in the bag. Both bags should be sealed and stored for 3-4 days.
10. Add a third bag of steel wool with and vinegar to represent acid rain.
11. [Distribute Steel Wool Lab sheet](#). Ask students to record the answers to the following questions on their lab sheet. In what way(s) are the bags the same? In what way(s) do the bags differ? What do you think will happen to the “dry” steel wool? Explain why you think this will happen. What do you think will happen to the “wet” steel wool. Explain why you think this will happen. What about the steel wool in vinegar?, etc. (Connections to ELA standards with how the students write their responses).

12. Collect or review shared google docs of the Steel Wool Lab sheet as an “exit ticket”/formative assessment for today’s activity.
13. Provide reminders about the field trip tomorrow and an overview of the next couple of days of the unit. We will come back to the Steel Wool Lab later in the week.

Vocabulary:

abrasion, acid rain, animal actions, carbon dioxide, freezing and thawing, living organism, oxygen, plant growth, release of pressure, water, chemical weathering, mechanical/physical weathering, erosion

Elaborate (Applications and Extensions:): Students will apply weathering and erosion knowledge through the application of exploring the properties of clay in a variety of hands on experiences in future lessons of this unit.

Evaluate:

Formative Monitoring (Questioning/Discussion): Formative learning is the KWL using Pear Deck at the beginning of the class and the Steel Wool Lab sheet when students are making predictions on what will happen to the steel wool on the lab sheet.

Summative Assessment (Quiz/Project/Report): Students will complete the report for the Steel Wool Lab on future class date. They will also have a formative/summative assessment on the Weathering and Erosion after day 6 of the lesson. Students will have a project based learning experience through making a project out of refined clay that was dug on the field trip.

LESSON PLAN 5E Model Day 2 Topic: Weathering and Erosion to Form Clay Deposits

1 day field trip to the river bank (or area where there would be clay deposits) to dig up clay.

Engage: Opening Activity-Access Prior Learning/Stimulate Interest/Generate Questions:

1. Seek prior approval from parks and recreation to be able to dig up small collections of ground for sampling.
2. Prior to leaving on the busses, watch a video clip of the artist Andy Goldsworthy creating his art (ice sculpture or the nest shaped stick formation and its interaction with the water tide). <https://www.dailymotion.com/video/x15e83f> starting at 6 minutes through 11 minutes or 11:45 minutes to 17 minutes.
3. Converse on the bus about Andy Goldsworthy, his background and influences to his art making and his use of natural resources in the process.

Explore/Explain: Lesson Description- Materials Needed/Probing or Clarifying Questions:

1. Ask students to gather natural materials (rocks, twigs, leaves, mud, sand, etc) from the site and create an artwork that reflects an investigation either the material itself or their interpretation of nature around them.
2. Have students document their product by sketching it in their sketchbook and reflect on the process as well as the product of the work. Why did you choose that resource to use in the creation of your artwork? What challenges did you face as you investigated how that material could be used to create a work of art? How did the surroundings of the site impact your work (ie. Goldsworthy's awe of how the sun hit the icicle sculpture in contrast to the dark cliff behind it)
3. Gallery walk around the site and have students share about their thought process and the influences that guided them in the production of their piece. Have students share any predictions or outcomes that they experienced as they were working with the natural resources. What challenges did they face when working with the material? Parent chaperones and/or teachers can video tape this process as a part of formal assessment evidence of students' learning.
4. Have students investigate and document the river ecosystem (<https://www.sciencelearn.org.nz/resources/439-river-ecosystems>, <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/river-ecosystem>) in their sketchbooks like drawing examples of plant life, organisms, animals, etc. That are around the area of where they have found clay. This could also be done through photography/videography What do they see around them? Describe the flow of the river. What kind of plant and animal life exists around this area of the river?
5. Transition into clay deposits. How do we distinguish clay from mud? (http://kremesti.com/water/silt_clay_mud.htm) What are the differences and similarities between clay and mud? What are the similarities and differences between clay found directly in the ground verses the clay that you work with in the art room? Have students predict where the best deposits of clay could be found.
6. Have small groups of students gather clay at different areas near the river (ie. in the river bed using the waders, on the riverbank, and various locations nearby the river. Each group will have on bucket, gloves, and shovels to dig up clay.
7. Once completed, clean up and pack up to head back to school.

Buckets with lids

Gloves

Shovels

Towels

Waders (like used in fishing to stand in the water)

8. Back in the classroom have students observe and document observations of the samples they took from the site.

9. Begin the refinement process of letting the samples settle over a day or two to continue refining into usable clay.

(Steps: 1. Let the particles settle to then sift off the excess water. Keep covered overnight as particles settle

2. Run the mixture through a variety of different sized sieves to separate out the particles from the mixture

3. Continue to push the mixture through the different sieves. This process could take multiple days.

4. Let the clay sit out on a plaster block or canvas covered board to dry out to a plastic consistency (no longer sticky to the touch

5. Clay is ready to be formed into something.)

Vocabulary:

abrasion, acid rain, animal actions, carbon dioxide, freezing and thawing, living organism, oxygen, plant growth, release of pressure, water, chemical weathering, mechanical/physical weathering, erosion, plastic

Elaborate: Applications and Extensions: Conduct a sludget test on the samples of mud/dirt water collected from the ground to identify the individual components of the samples (ie. organisms, sediments, etc) as the samples are refined into usable clay.

The EPA

(<https://www.epa.gov/students/lesson-plans-teacher-guides-and-online-environmental-resources-educators>) has lesson ideas that could be an extension of this lesson).

Students would try to identify the different elements of the sludge through scientific investigations.

Evaluate:

Formative Monitoring (Questioning/Discussion): Formative monitoring for this day's activity happened through discussions on the bus and at the field trip site. In addition, the students creating and sharing about their projects in response to the environment around them can be formative assessment. Students documenting their creation and reflecting upon it in their sketchbooks serves as formative assessment and can also be used as in addition to the summative project towards the end of this unit.

Sketchbooks are collected as a formative assessment in response to the field trip.

Students can also write reflections on their experiences so far and tie their knowledge of the connections between science and art in their sketchbook as a journal entry.

Summative Assessment (Quiz/Project/Report): They will also have a formative/summative assessment on the Weathering and Erosion after day 6 of the lesson. Students will have a project based learning experience through making a project out of refined clay that was dug on the field trip.

LESSON PLAN 5E Model Day 3 and 4 Topic: Continuation of Weathering and Erosion to Form Clay Deposits (from day 2)

Engage: Opening Activity-Access Prior Learning/Stimulate Interest/Generate Questions: (15 minutes)

1. Return sketchbooks to students with feedback and comments on their reflections from the field trip day.
2. Set out 3-5 different types of clay bodies: porcelain, stoneware and earthenware (<https://kilnarts.org/education/ceramic-pottery/the-basics-of-clay/types-of-clay/>) that range in a variety of colors at each table. Set out examples of different [states of clay](#) (ie. slip, plastic, leatherhard, and bisque).
3. Have students investigate through sight, touch, smell, in small groups and document their findings on the different clays, comparing and contrasting each type of clay and stage of clay. [They will record their findings on a Google doc distributed to the class through the Google classroom site.](#) (clays vary in color based on oxides in the ground where it is found and clay consistency varies (some have sand or grog in it to impact strength and durability and also how smooth it is to work with)

Explore/Explain: Lesson Description- Materials Needed/Probing or Clarifying Questions

(15 minutes)

3. Students will read through [Tulane University Weathering and Clay formation](#), the United States Geological Survey www.usgs.gov and https://www.theartofed.com/packs/build-ceramics-program-ground/?open_download=1
4. Using the information gathered from these two texts they will then as a small group (table of 3-4 students) classify the different clay bodies into one of the three categories
 - a. Porcelain
 - b. Stoneware
 - c. Earthenware
5. As a class come together and discuss findings and share classifications. What factors contribute the to the clay classifications? How do we know the difference in Terra Cotta versus Porcelain beyond the color of the clay? Students will make claims on their classifications and support with evidence from their learning and the websites.

Vocabulary:

abrasion, acid rain, animal actions, carbon dioxide, freezing and thawing, living organism, oxygen, plant growth, release of pressure, water, chemical weathering, mechanical/physical weathering, erosion, bentonite, kaolinite, oxides, porcelain, stoneware, earthenware, grog

Elaborate: Applications and Extensions: (15 minutes)

6. Students then look at three different applications of clay through history.

- a. [Egyptian Pyramids](#)
- b. [Black Clay from Oaxaca Mexico](#)
- c. [Chinese Porcelain](#)

(Optional) Students could investigate building structures with different types of clay, comparing its elasticity, strength and durability before it is kiln fired and also after it is kiln fired.

Evaluate:

Summative Assessment (Quiz/Project/Report): Students would [complete a reflection or report on what factors contributed to the clay used by each culture](#). Was this purely accessibility to the material? Was it also because of the intended function of the final product? What are the economic implications of these cultures using a natural resource (clay)? How do we [use clay](#) in modern day? How has technology and society over time changed use of clay materials? Students need to incorporate knowledge of the compositions of different clay bodies and how these clay bodies influence how they are used.

LESSON PLAN 5E Model Day 5 and 6 (continuation of day 1)

Engage: Opening Activity-Access Prior Learning/Stimulate Interest/Generate Questions: (5-10 minutes) Review and go over results from the Assessment on Weathering. Review chemical and physical weathering processes and how they change the Earth. Review the lab instructions for the Steel Wool Lab and hand back collected lab sheets (or students access the Google doc of the lab started on day 1)

Explore/Explain #1: (30-40 minutes) Chemical weathering breaks down iron or rock materials into smaller and smaller pieces. The process causes permanent change to the materials.

1. Ask students to examine the wool from the “dry” bag. Ask students to draw and record a description of its appearance.

Teacher Note: Caution: Be careful with the steel wool. Do not let students handle it with their bare hands.

2. Debrief the exploration by asking the following questions. Ask students to record drawings and explanations in their science notebook.

- a. Draw and describe the wool in the dry bag.
- b. Was this an example of mechanical/chemical weathering? Explain how you know.

3. Repeat steps 1 and 2 while examining the steel wool from the "wet" bag. Ask students to answer the following questions:

- a. Draw and describe the materials appearance.
- b. Was this an example of mechanical/chemical weathering? How do you know?

4. Debrief the wet and dry bag observations by asking the following questions. Ask students to answer the following questions in their science notebook. In what ways are the contents of the bag the same? In what ways do the bags differ? Was it easy or hard to pull the wool apart from the "dry" bag? How were the wet and dry steel wool different? What caused the changes in the wet steel wool? What kind of weathering is this? Mechanical or chemical?

5. Display a thin layer of granite rock from a hillside with chemical weathering of granite. Explain to students that the granite rock was chemically weathered and is "flaking off" of the hillside. How is the chemical weathering of granite like the chemical weathering of iron in the wet bag?

Explore/Explain #2 (15-20 minutes) Mechanical weathering breaks rocks into smaller and smaller rocks. Living things and physical movement or temperature change all cause physical weathering.

5. Distribute a handful of gravel to each group and ask students to make observations about the gravel and share with a partner.

6. Lead a class discussion about their observations regarding the shapes of the rocks and the formation of the rocks in the gravel.

7. Explain to students that since we cannot actually break apart rocks, we will be using sugar cubes as our model to show how rocks tumble and weather. [Distribute Sugar Cube Lab \(or use Google Docs to complete lab\)](#) and materials to complete sugar cube lab to each group of 2-4 students.

8. Ask the students to describe the appearance of the sugar cubes. Ask students to make a drawing of the sugar cubes.

9. Ask the students to place the sugar cubes in a jar. Ask students to predict what they think will happen to the sugar cubes when they are shaken 20 times.

10. Now, ask students to shake their cubes 20 times and record their observation on the lab document.

11. Ask the students to pour the contents of the jar onto a piece of paper separating the sugar cubes and the crumbs. (Don't let students eat any of it)

12. Ask students to answer the following questions on the lab document including recording any changes they notice in the cubes. Make a drawing of their observations. Record if these changes are due to chemical or physical weathering? How do you know?

13. Ask students to return the sugar cubes to the jar and shake another 20 times.

14. Ask students to again pour out the contents onto a piece of paper separating the crumbs from the cubes, and make a drawing of their observation.

15. Ask students to observe any changes in the sugar cube and any parts create by the shaking.

16. Lead a class discussion using the following questions: What change did you notice in the cubes? Were these changes due to chemical or physical weathering? How do you know? What reason (s) did you give for these changes? How did the second shaking change the cubes appearance? Is the amount of crumbs great than, the same as or less than the first shaking?

17. How are the weathered sugar cubes the same or different from the rocks in the gravel? What might have formed the rocks into the gravel from larger rocks?

Elaborate: Applications and Extensions: (15 minutes) Mechanical and chemical weathering is evidence in natural settings (school yards or close walks to the school)

18. Ask the students to record in science notebooks what they know for sure about physical and chemical weathering using the [Weathering Wrap-up activity](#). Then ask students to draw an illustration for each type of weathering. This can be peer reviews as another point of formative assessment in preparation for the assessment on day 7.

Extend/Evaluate: (15 minutes) Mechanical and chemical weathering are destructive forces that change the Earth. Each type of weathering has different characteristics.

For Homework:

19. Ask students to walk around the school to identify examples of mechanical weathering (broken concrete/sidewalk) and chemical weathering using the

Mechanical and Chemical Weathering at School and In Your Neighborhood document.

20. How are these destructive forces (chemical and physical weathering) changing the Earth?

21. Draw and describe an example of chemical and physical weathering from the neighborhood.

[Assessment \(to be administered on day 7\)](#): Assessment can be used both formatively and summatively to assess student learning and identify intervention needs.

LESSON PLAN 5E Model Day 7-11 Topic: Artistic Investigation of the Properties of Clay (from the field trip) and using the Design Process to formulate a 3D object (functional or decorative) that represents a historical or modern day culture. (the length of time needed would depend on how much clay was gathered and refined on the field trip)(this lesson could be supplemented with additional clay bought from a company that mills clay from the ground for classroom/studio use)

Science and Engineering Connection: This is tying in engineering design because students have to decide the size of what they are going to create based on the amount of clay they have, if they only have enough clay to create a mug but the mug can only hold a mL of liquid is it really a functional form. The connection to science is drawing connections based on the stages of clay. There is a point where clay is no longer renewable/reusable to make a new form (using non-renewable resources because when clay is used and fired in a kiln it is no longer renewable, clay prior to the firing stage is renewable).

Engage: Opening Activity-Access Prior Learning/Stimulate Interest/Generate Questions: (10 minutes)

1. Review the lesson activity studying the Egyptian Pyramids, Black Clay from Oaxaca Mexico, and Chinese Porcelain.
2. Ask students to define function and sculptural forms. Students can Think-Pair-Share with a partner and then share out their thoughts. What is a functional form? How do we know? What is a sculptural/decorative form? How do we know? Which culture that we reviewed would be an example of functional product? Which culture that we reviewed would be an example of sculptural/decorative form? How do we know?

Explore/Explain: (20 minutes)

1. Create preliminary sketches/design of a functional or sculptural form that will be created from the clay we refined from the ground (and/or using store bought clay). It would still be valuable to make something out of the clay refined from

the field trip so that they can observe the changes in its properties as it is fired in the kiln. They can compare this to the store bought clay as well. Students will need to estimate or predict how big their project will be based on the amount of clay they have from the field trip (assuming they don't have any access to store bought clay)

2. Have students reflect in their sketchbooks. How would this form (functional or sculptural) represent a positive aspect of your identity as a person or as reflection of historical or current day culture? (Drawing connections from the innovations of Egyptian Pyramids and the bricks we use to build houses in current day) Could something be both functional and sculptural? How do we know?

3. Share [slide deck](#) on the different process of clay and also [links to video](#) demonstrations of each process. Teacher Demonstration on the different processes of building in clay. Students can choose which process(es) are most appropriate for the design they have sketched.

Vocabulary:

plastic, leatherhard, slip, score, bone dry, bisque, kiln, form, coil building, slab building, pinch pots, additive/subtractive building

3. Students will get their clay and tools and begin building their forms. (continue over days 8-11).

Elaborate: Applications and Extensions: (15 minutes)

On day 11:

4. Once clay forms have been fired to the bisque state of clay. Have students make observations of the differences between slip, plastic, leatherhard and bisqued clay. What happens to the clay when it is heated to high temperatures? Is this a chemical change? <https://eic.rsc.org/feature/the-chemistry-of-pottery/2020245.article>

Elaborate/Extend (optional): Have students investigate the properties of ceramics glazes and have them research and develop their own recipe to be applied to their clay projects.

Evaluate:

Formative Monitoring (Questioning/Discussion): Formative monitoring in the project based learning experiences happens when the teacher circulates the room as students are working asking them questions as they work and assisting them if needed. What are you making? How are you making it? What challenges are you facing/overcoming? What do you need from me? Do you have any discoveries that you can share with me, your table or the whole class?

An exit slip/ticket to exit on one of the studio days can be answering the question(s):

How has your knowledge of Weathering and Erosion influenced your work with clay?
If a clay body was at the bone dry stage what do you predict would happen to it as it soaked in water for several days?
If a clay body that was bisque (kiln fired) what do you predict would happen to it as it soaked in water for several days?

Summative Assessment (Quiz/Project/Report): The final product will be assessed [using a project rubric](#) once the clay project has been fired in the kiln and either painted with acrylic paint or glazed with ceramic glaze. Students will also [self-assess and reflect](#) on their project.

Elaborate Further/Reflect: Enrichment: Paint vs. Glaze, Food safe vs not food safe, Underglaze, Sgraffito, Mishima and other decorative techniques for clay. Students can investigate and choose between a variety of finishing techniques for their clay projects.

Resources

Art of Ed: Types of Clay Bodies

https://www.theartofed.com/packs/build-ceramics-program-ground/?open_download=1

History and Benefits of Clay

<https://www.enviromedica.com/learn/history-and-benefits-of-clay/>

Pottery in Antiquity <https://www.ancient.eu/pottery>

Ancient Pottery <http://www.visual-arts-cork.com/pottery.htm>

Weathering and Clay Minerals

<https://www.tulane.edu/~sanelson/eens211/weathering&clayminerals.htm>

Illinois Visual Arts Standards

<https://www.isbe.net/Documents/Visual-Arts-Standards.pdf>

Next Gen Science Standards <http://www.nextgenscience.org/>

Common Core State Standards <https://www.corestandards.org>

United States Geological Survey www.usgs.gov

Mexican Folk Art Guide Black Clay from Oaxaca Mexico

<https://www.mexican-folk-art-guide.com/black-clay.html#.W99jbxNKjEY>

Khan Academy South East Asia Chinese Porcelain Pottery

<https://www.khanacademy.org/humanities/ap-art-history/south-east-se-asia/china-art/a/chinese-porcelain-production-and-export>

How the Egyptians Actually Built the Pyramids

<https://medium.com/@axlright/how-the-egyptians-actually-built-the-pyramids-matters-to-climate-change-c364e696b391>

USGS.gov Commodity/Clays

<https://minerals.usgs.gov/minerals/pubs/commodity/clays/stat/tbl40.txt>

USGS.gov Minerals/Commodity/Clays

<https://minerals.usgs.gov/minerals/pubs/commodity/clays/>

Misconceptions About Weathering and Erosion

<https://beyondpenguins.ehe.osu.edu/issue/earths-changing-surface/common-misconceptions-about-weathering-erosion-volcanoes-and-earthquakes>

Next Gen Science Standards Learning Progressions

<https://www.nextgenscience.org/sites/default/files/resource/files/AppendixE-ProgressionswithinNGSS-061617.pdf>

The Chemistry of Pottery

<https://eic.rsc.org/feature/the-chemistry-of-pottery/2020245.article>

Science Matters Earth Science: Weathering and Erosion

<http://sbsciencematters.com/lesson-units/6th-grade/6th-earth-science-weathering-erosion/>

