

Data Integration Project  
SCED 549 Methods of STEM  
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October 15th 2018

## Introduction

The data site that I am using for this project is a site based on geography, called the U.S Geological Survey. The parent site is [www.usgs.gov](http://www.usgs.gov). I currently teach art and my specialty is ceramics (clay). When I teach clay, we engage in an overview of where clay comes from and how it forms as a result of weathering and erosion. Under the USGS website I found this page, <https://minerals.usgs.gov/minerals/pubs/commodity/clays/>, which is minerals information for the United States. “Six types of clays are mined in the United States: ball clay, bentonite, common clay, fire clay, fuller's earth, and kaolin. Mineral composition, plasticity, color, absorption qualities, firing characteristics, and clarification properties are a few of the characteristics used to distinguish between the different clay types.” Using the USGS.gov website is a way to make a strong connection between science and art. The article “Environmental Characteristics of Clays and Clay Mineral Deposits” explains weathering and erosion through the physical and chemical properties of clay (<https://pubs.usgs.gov/info/clays/>).

The Next-Gen Science Standards that apply the most to this data integration are “MS-PS1-2 Matter and Interactions: Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred” and “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” (<http://www.nextgenscience.org/>). The first standard is addressed through the investigations of clay bodies, their uses and once fired in the kiln the changes that have occurred. The engineering design standard is met when students are actively engaging in the planning, producing and revising stages of creating a clay project. Additionally, the CCSS ELA standard also applies to this data integration. “CCSS.ELA-LITERACY. RST 6-8.3: Follow precisely multistep procedure when carrying out

experiments, taking measurements, or performing technical tasks”

(<http://www.corestandards.org/ELA-Literacy/RST/6-8/>). This standard is easily applicable in the visual arts as students need to follow steps for specific processes, like clay, so that the project will survive the kiln firing. For example, students must use proper attaching techniques in clay otherwise once the water is evaporated and all moisture burned out in the kiln, the clay pieces will not stick together anymore. Prior to kiln firing, unless students slip and score pieces together, the only thing holding the clay together is the properties of water. If the water is gone, there isn't anything holding two clay pieces together. This process also affects the integrity of the structure. Finally, this data integration also meets the National Core Art Standards and the Illinois Visual Arts Standards as well. Specific standards for the 8th grade level are “VA:Cr1.1.8a:Document early stages of the creative process visually” and “VA:Re8.1.8: 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”

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

### **Data-Driven Decision Making and Student-Centered Investigations**

The data and information from this website can provide a stronger connection of clay and its many uses: art and non-art. This [table](#) found on USGS.gov lists the uses of clay, which kind of clay was used for that need. For example, clay is used as an absorbent material, roofing granules, floor and wall tiles, bricks and flower pots, and more. The goal of using this data would be to expand students knowledge of how clay is used outside of the art classroom. Additionally, student-centered investigations could be initiated with this data to have students test the strengths and absorbency of different clay bodies. What are best uses for the different types of

clay? Students can evaluate strengths and uses based on color, texture, plasticity, “crash tests” of fired (in the kiln) clay bodies to assess durability and fragility, and more. Students would record these observations as they tested, touched and experienced the clay bodies at different stages: plastic, bone dry, and kiln fired. Lastly, students could engage in a field experience where we took a trip to a river bank or shoreline of a lake to mine our own clay from the ground and analyze it and use a refinement process to sift out rocks, plant and animal matter, and then turn it into a usable clay body. This is an activity I actually did in my undergraduate ceramics class. We dug up clay from the river bank near Anderson, Indiana, refined it through various process and then formed it into a three dimensional form. Somewhere in my basement, I have the clay bowl that I made from the clay I dug up and refined. This also reminded me of the “sludge test” I did in earth science as a freshman in high school.

### **Lesson Enhancement and Interdisciplinary Context**

I teach art and working in clay is one of my specialities. It is a curricular experience that all of my students have in my classroom. We touch on the properties of clay, the chemistry of clay, weathering and erosion, and the physics of working with clay. Using the data from the U.S. Geological Survey can provide students with investigations on different clay bodies, the geographical location that the clay came from, and its specific mineral make up. I do aim to offer choices in my classroom whether it be technique choices, material choices, or subject matter choices. Based on the investigations of clay bodies mentioned in the *Data-Driven Decision Making and Student-Centered Investigations* section of this paper, students could then choose what type of clay would best serve their final product idea. If they want their project to withstand the elements of the outdoors they would need to investigate whether terra cotta, raku clay, stoneware or porcelain would be best. Or if they want it to be a decorate (non-functional) piece

of art which clay would they use? Students would make these choices based on the observations of data integration and clay investigations conducted prior to engaging in the design process to formulate an artistic investigation of clay. Much like the nature of using data in assessment, as a way to acquire formative and summative feedback on students' learning, data can be integrated as a starting point or along the process of learning experiences for students and using the data to influence outcomes of the learning.

In a project-based learning environment, students would then design and create a form out of clay, choosing from a variety of handbuilding options: pinch pot building, coil building and slab building. As a result, students engage in investigations about the science and nature of clay bodies and then produce a creative product as a result of the data obtained. This lesson integrates geology, physics and chemistry of clay, into art and making art. The chemistry aspect comes from the properties of clay changing when responding to heat (the kiln) and the chemistry of making glazes. Beyond the connection of science and art, when students are making observations and writing reflections throughout the process they would need to rely on ELA knowledge to make claims and support claims with evidence through this process, tying in ELA standards.

## **Conclusion**

Using the USGS website to create interdisciplinary connections between science, art and language arts will provide students with avenues to create artistic and scientific investigations and utilize the engineering design process while making observations, using evidence and reasoning to support claims, and producing projects that represent a culmination of the data investigations. "Students who participate in scientific practices, such as, questioning, hypothesizing, investigating, developing models, interpreting and analyzing data, linking

conclusions to data, and sharing findings with others, are able to develop and provide meaning to knowledge and explanations of the natural world (Michaels, et. al, 2008)” (as cited in Cotabish, et.al., 2013, p. 218). Integrating geology with clay is a seamless way that extensively integrates science learning with artmaking to effectively meet the learning expectations across both content areas with the support of English Language Arts standards.

## References

Cotabish, A., Daily, D., Robinson, A., and Hughes, G. (2013). The effects of a STEM intervention on Elementary Students’ science knowledge and skills. *School Science and Mathematics*. 113(5), 215-226.

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](http://www.usgs.gov)