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| **Lesson Title : Intro to Destructive Earth processes** | **Unit #:****1** | **Lesson #:****1** | **Activity #:****1** |
| **Activity Title: The Hook and Essential Questions** |

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| **Estimated Lesson Duration:** |  **4-5 Days (50 minute periods)** |
| **Estimated Activity Duration:** | **2 days (50 minute periods)** |

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| **Setting:** | **Classroom and possibly outside for the relay race** |

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| **Activity Objectives:** |

1. Students will be able to recognize and describe destructive Earth processes that they

 observe: weathering, flooding, erosion, soil movement, water pollution.

1. Students will be able to describe some problems that these destructive processes cause for humans.
2. Given the Topic (Farm erosion and eutrophication) and Big Idea (Minimizing erosion), students will contribute to forming some essential questions.

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| **Activity Guiding Questions:**  |

1. Which destructive Earth processes have you seen?
2. Why are these processes considered destructive?
3. What are some problems that these processes can cause for humans living in that area?
4. Given this Big Idea of minimizing erosion and the Topic of Farm erosion and eutrophication, what are some good Essential Questions?
5. What might be a good Challenge related to the Essential Question that we selected?
6. How strong is the force of moving water when it is eroding soil on a sloped surface?
7. Which materials are eroded easily?
8. ­­­­­What other problems are related to the erosion of farmland?

| **Next Generation Science Standards (NGSS)**  |
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| **Science and Engineering Practices (Check all that apply)**  | **Crosscutting Concepts (Check all that apply)** |
| ☒ Asking questions (for science) and defining problems (for engineering) | ☐ Patterns |
| ☐ Developing and using models | ☒ Cause and effect |
| ☐ Planning and carrying out investigations | ☐ Scale, proportion, and quantity |
| ☐ Analyzing and interpreting data | ☐ Systems and system models |
| ☐ Using mathematics and computational thinking | ☒ Energy and matter: Flows, cycles, and conservation |
| ☐ Constructing explanations (for science) and designing solutions (for engineering) | ☐ Structure and function.  |
| ☐ Engaging in argument from evidence | ☒ Stability and change.  |
| ☒ Obtaining, evaluating, and communicating information  |  |

| **Ohio’s Learning Standards for Science (OLS)** |
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| **Expectations for Learning - Cognitive Demands (Check all that apply)** |
| ☐ Designing Technological/Engineering Solutions Using Science concepts **(T)** |
| ☐ Demonstrating Science Knowledge **(D)** |
| ☒ Interpreting and Communicating Science Concepts **(C)** |
| ☒ Recalling Accurate Science **(R)** |

| **Ohio’s Learning Standards for Math (OLS) and/or** **Common Core State Standards -- Mathematics (CCSS)** |
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| **Standards for Mathematical Practice (Check all that apply)** |
| ☐ Make sense of problems and persevere in solving them | ☐ Useappropriate tools strategically |
| ☐ Reason abstractly and quantitatively | ☐ Attendto precision |
| ☐ Construct viable arguments and critique the reasoning of others | ☐ Look for and make use of structure |
| ☐ Model with mathematics | ☐ Look for and express regularity in repeated reasoning |

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| **Unit Academic Standards (NGSS, OLS and/or CCSS):** |

 OLS: ESS: A combination of constructive and destructive geologic processes formed

 Earth’s surface.

 NGSS: - Demonstrating science knowledge

 - Interpreting and communicating science concepts

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| **Materials**: (Link Handouts, Power Points, Resources, Websites, Supplies) |

1. Printed photos for the Gallery Walk
2. [Answer sheet for Gallery Walk](file:///C%3A%5CUsers%5CCHEE-User%5CDocuments%5CRET%202018%5CGallery%20Walk%20Questions.pdf)
3. Supplies for the Erosion Relay race: Per group- Basin, Spray bottle filled with water,

 board with “sand castle” (made with Solo cup and wet sand)

1. Video clip from YouTube
2. [Worksheet for Big Idea/ Essential Questions](file:///C%3A%5CUsers%5CCHEE-User%5CDocuments%5CRET%202018%5CBig%20Idea%20Essential%20Question%20Activity.pdf)/ [Challenge sheet](file:///C%3A%5CUsers%5CCHEE-User%5CDocuments%5CRET%202018%5CChallenge-%20Save%20the%20Soil%21.pdf)

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| **Teacher Advance Preparation:** |

 **Day 1:** Hang up Gallery Walk photos, make copies of Answer sheets, set up materials for

 Erosion Relay race.

 **Day 2:** Make sure link to YouTube video is working, make copies of Big Idea/ Essential

 Question/ Challenge worksheets

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| **Activity Procedures:** |

 **Day 1:** -Have students circulate through all of the photos in the gallery walk and record

 their responses on the provided sheets.

 -Collect the sheets for daily grade (formative assessment).

 -Organize students into teams, explain the goal of the relay race (completely wash

 all of the sand castle off of a board using a spray bottle, ten squirts per student) and begin the race.

 -Dismiss class or (if time remains) discuss the purposes of that day’s activities.

 **Day 2:** - Show the YouTube video clip (“Eutrophication Explained” and “The Force of Water Takes Out a Road”)

 - Pass back responses from yesterday’s Gallery Walk and quickly discuss

 reactions to photos.

 - Distribute Big Idea/ Essential Question/ Challenge worksheets and work through

 as a class and in pairs (think/pair/share or similar method)

 - Collect their work, tell students that all ideas will be reviewed so that Challenge

 can be determined.

**Formative Assessments:** Link the items in the Activities that will be used as formative assessments.

1. Gallery Walk response sheet will be collected for review and a daily grade. On the following day, it will be passed back and briefly discussed; participation during the discussion could be recorded for a grade.
2. Big Idea/ Essential Questions/ Challenge worksheet will also be collected for review and a daily grade.

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| **Differentiation:**  |

Students may be paired with a suitable partner during the Gallery Walk. Number of answers needed on worksheets will be modified/ reduced as needed for individual cases. Groups for the relay race will be formed heterogeneously. Students will be paired with a suitable partner during the think/pair/ share section of the Big Idea/ Essential Questions/ Challenge activity. Pairing with a suitable partner is easily accomplished by carefully making a classroom seating chart based on student attributes earlier in the year; then students can pair up with their immediate neighbors.

**Summative Assessments:**

None in this activity

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| **Reflection:** Reflect upon the successes and shortcomings of the lesson. |

Day 1: Gallery Walk- I paired up the students and gave each pair a clipboard for writing their answers more easily. Students were intrigued about this activity, as it was a first time experience for most of them. The activity went really well, with me calling out for groups to rotate to a new picture in 90- second intervals. To direct the students’ thinking and get the most educational good from this activity, I had typed up a list of questions that students were to respond to at each picture, usually three per photo. Keeping things moving and requiring partners to take turns with the writing of answers ensured that distractions were kept to a minimum and each student was involved. I would do things the same

 way next time.

 Erosion Relay Race- Since this was a hands-on activity and it was set up as a competition, it was really easy to get most of the students on board. I set up the materials at one end of my classroom and had two groups of students at the other end. I made a ten-squirt limit per student with the spray bottles, and was surprised by how long it actually took for a sand castle made out of a Solo cup to be completely eroded. Several classes ran out of time before the castle was completely eroded, but it wasn’t a big problem; the experience gave us enough information to quickly debrief the following day. Next time, I might use a smaller cup to make the sand castle.

Day 2: Video clips- The video about Eutrophication Explained was a nice animated way to introduce a complicated concept to middle school students in an age-appropriate way. This video gave me a chance to quickly talk about how nutrients and chemicals get into a lake and cause problems. The video showing how an asphalt road over a stream fascinated many students as they watched the flood water undercut the soil, take away huge chunks of asphalt, and finally lift up the culvert and take it as well. This video gave me a chance to quickly show the force of the water during a storm and how much material it can carry with it. I would use both of these videos again.

 Gallery Walk review- I quickly reviewed the answers to the Gallery Walk, calling on every pair of students at least once. This was a good chance to address any misconceptions and for students to gain some buy-in to the activity with their ideas. I use this technique often with my middle school students with good success. I would use this again.

 Big Idea/Essential Questions activity- The first two sections of this worksheet were completed as a guided activity with whole-class participation. The third part was completed as a Think/Pair share activity, and the last part was completed individually as a homework assignment because class time ran out. I was able to tell my students that their individual answers and ideas would be read and considered for a challenging project that we would be working on. I was surprised by the diversity of ideas that were generated; some of the ideas were very informative about whether the activities so far had been effective in relaying the Big Idea to students. In most cases, the students provided ideas that were relevant to the intended purpose of this CBL unit.