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| **Lesson Title : Minimizing Erosion** | **Unit #:****1** | **Lesson #:****2** | **Activity #:****4** |
| **Activity Title: EDP Challenge-Save the Soil!** |

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| **Estimated Lesson Duration:** | **5-6 days (50-minute periods)** |
| **Estimated Activity Duration:** | **6 days (50-minute periods)** |

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| **Setting:** | **Classroom** |

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| **Activity Objectives:** 1. Students will work together in teams to design a solution for an erosion problem on a sloped surface.
2. Students will identify erosion control techniques via research activities.
3. Students will apply research findings to build an effective model that minimizes erosion.
4. Students will communicate their solution to classmates in an effective way.
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| **Activity Guiding Questions:**1. What methods are effective for reducing erosion on a slope?
2. Which materials can help to control erosion?
3. How will success be measured in this challenge?
4. How many techniques should be used in the model?
5. How can erosion be mitigated on a sloped surface?
6. How can our results be communicated effectively?
7. What data can be collected to indicate success?
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| **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.

 PS: Forces have magnitude and direction.

 **NGSS:** - Designing technological/engineering solutions using science concepts

 - Demonstrating science knowledge

 - Interpreting and communicating science concepts

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

1. Student copies of EDP flowchart, Research worksheet, Brainstorm & Planning sheet, Data packets per team, Conclusion sheets and Posttests
2. Materials for the challenge
3. PowerPoint slides or Poster paper for presentation

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| **Teacher Advance Preparation:** |

 - Make copies of all papers

 - Gather all materials and verify quantities

 -Check functions of all measuring equipment

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| **Activity Procedures:** |

 Day 1: -Introduce the challenge and generate guiding questions

 -Show topographical map and choose a plot from options

 -Show students the control farm (normal, nothing changed) and measure the runoff water and

 sand.

 -Review the EDP process

 -Begin research in class, finish for homework if needed

 Day 2: -Teacher assigns student groups and each group then assigns roles

 -Teams put research results together and use them to brainstorm

 -Teams use brainstorming to plan on paper what they will build; provide labeled sketch with

 pros and cons listed

 -Choose best plan and have it approved by teacher

 Days 3-5: -Each student group will build a model according to the plan and have it checked by

 teacher

 -Test the model and record results

 -Redesign plan to improve it; get new plan approved, then build and test it, collect data

 -Redesign for one more time, get approval, test it and collect data

 -Make conclusions based on data collected

 -Prepare a poster or PowerPoint slides with relevant information to be shared in a presentation

 Day 6: -Groups present their results to the class with one poster or two PowerPoint slides

 -Students fill out a rubric/questionnaire for classmates’ presentations

 -Each student takes the Posttest

**Formative Assessments:**

1. Teamwork can be evaluated as a formative assessment grade if desired.
2. The results from research, brainstorming, and planning can be used to assess daily grade(s).
3. Model-testing results can be used as formative results.

**Summative Assessments:**

1. The final model test can be used as a summative assessment.
2. The presentation can also be used here if an appropriate rubric is given prior to presentations.
3. The posttest can also be used here.

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| **Differentiation:**  |

 To maximize success for all students in this stage of the unit, groups will be chosen carefully to ensure that each is as heterogeneous and harmonious as possible. Worksheets can be reduced or modified when needed, and roles should be chosen so that they cater to each student’s strengths. For the posttest, the usual accommodations will be given for students who receive them.

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| **Reflection:** My list of activities for the first day turned out to be too ambitious. I did not have enough time to introduce the topographical model, so showing students where the sloped farmland was did not actually happen until after the trials and presentations took place. This did not ultimately have an impact on the outcomes of the lab trials. I also made a mistake in the way that I assigned the research assignment. The original goal had been for students to each complete the entire assignment independently so that each would bring a wealth of ideas back to the group the following day. Because of time constraints, this research activity had to be assigned completely as a homework activity at the end of class on day 1, so I made a concession that students only had to complete half of the objectives on the worksheet. Because many of the students chose to complete the parts that seemed to be the easiest, this resulted in areas of research that were left undiscovered until too late in the process. On days 2-5 when groups were trying to decide which erosion methods to use, there was confusion about how to use some of the materials because the research had not yet been completed for those methods. Next time I will require that all research questions be completed by each student. The trials went really well once each group got comfortable with the roles that they had assigned and after learning the process to follow for setting up, testing, and collecting data afterward. It really helped me logistically to have one student in each group to manage materials, another for keeping track of documents, and a third for managing the group and relaying questions to me when needed. Since my focus in this challenge was about teaching students about erosion, the main goal of this project was to expose students to as many different erosion control methods as possible with the intent of seeing which ones worked best. There was no competition between groups; instead, it was neat to see students within each group get excited about what they could test in their next trial with the hopes of losing fewer grams of sand and fertilizer from the farm. Because of time constraints at the end of the project, I made the decision for all groups to complete a poster for their presentations instead of offering the choice between a poster or PowerPoint slides. Next time I plan to offer a choice to see if the technology option yields better results (poster products showed a wide variety in terms of quality). In each group’s presentation, the students were tasked with telling the class which combination of erosion control methods they would recommend to a farmer. As I listened to each presentation, it became clear to me which students had really internalized the concepts from this challenge. I ended up using the posttest scores as the only summative assessment in this project. All of the content covered during this project will also be represented in the unit test that I give four weeks later, so I did not see a need at this stage for additional assessments. |