

Don't Let Soil Get Carried Away

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RET Lab Experience Research Summary

Research Background

Erosion is a natural phenomenon responsible for landforms that brings some unique challenges for earth and its inhabitants.

- Decrease in soil fertility and flooding
- Health Risks such as valley fever and other diseases
- Traditionally engineers have been using water, mulch, & vegetation to prevent erosion.



RET Lab Experience Research Summary

Research Background

- CBBG (Center for Bio-Mediated and Bio-Inspired Geotechnics) is researching sustainable and bio-inspired methods to reduce soil erosion and strengthen soil.
- EICP (Enzyme Induced Carbonate Precipitation) is a bio-inspired and bio-mediated method that strengthens soil



RET Lab Experience Research Summary

Research Objectives

- Prepare, test, and compare the application of different EICP solutions for strengthening soil.
- Study the performance of different EICP solutions on mitigation of erosion on different soil types.



RET Lab Experience Research Summary

Research Objectives

- Measure the Carbonate content of EICP treated soil by using a calcimeter and perform SEM and Optical Microscope imaging.



RET Lab Experience Research Summary

Research Conclusions

- Soil loss is higher in finer sand than coarse sand
- Steep angle slopes cause a bigger amount of soil loss.



RET Lab Experience Research Summary

Research Conclusions

- EICP treated soil is 3 to 4 times stronger as measured by penetrometer testing
- 1M urea 0.67M CaCl_2 EICP solution soil samples exhibited the highest penetration resistance (105 kpa)



RET Instructional Lesson Implementation

Lesson Description

This lesson is part of a unit about Soil erosion. Students will explore different types of erosion and the factors that affect erosion (slope, particle size, wind speed etc).



RET Instructional Lesson Implementation

Standards

- NGSS: ESS2.A: Earth Materials and Systems: Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4-ESS2-1)
- AZ State Standards :4. E1U2.10 Define problem(s) and design solution(s) to minimize the effects of natural hazards.

RET Instructional Lesson Implementation

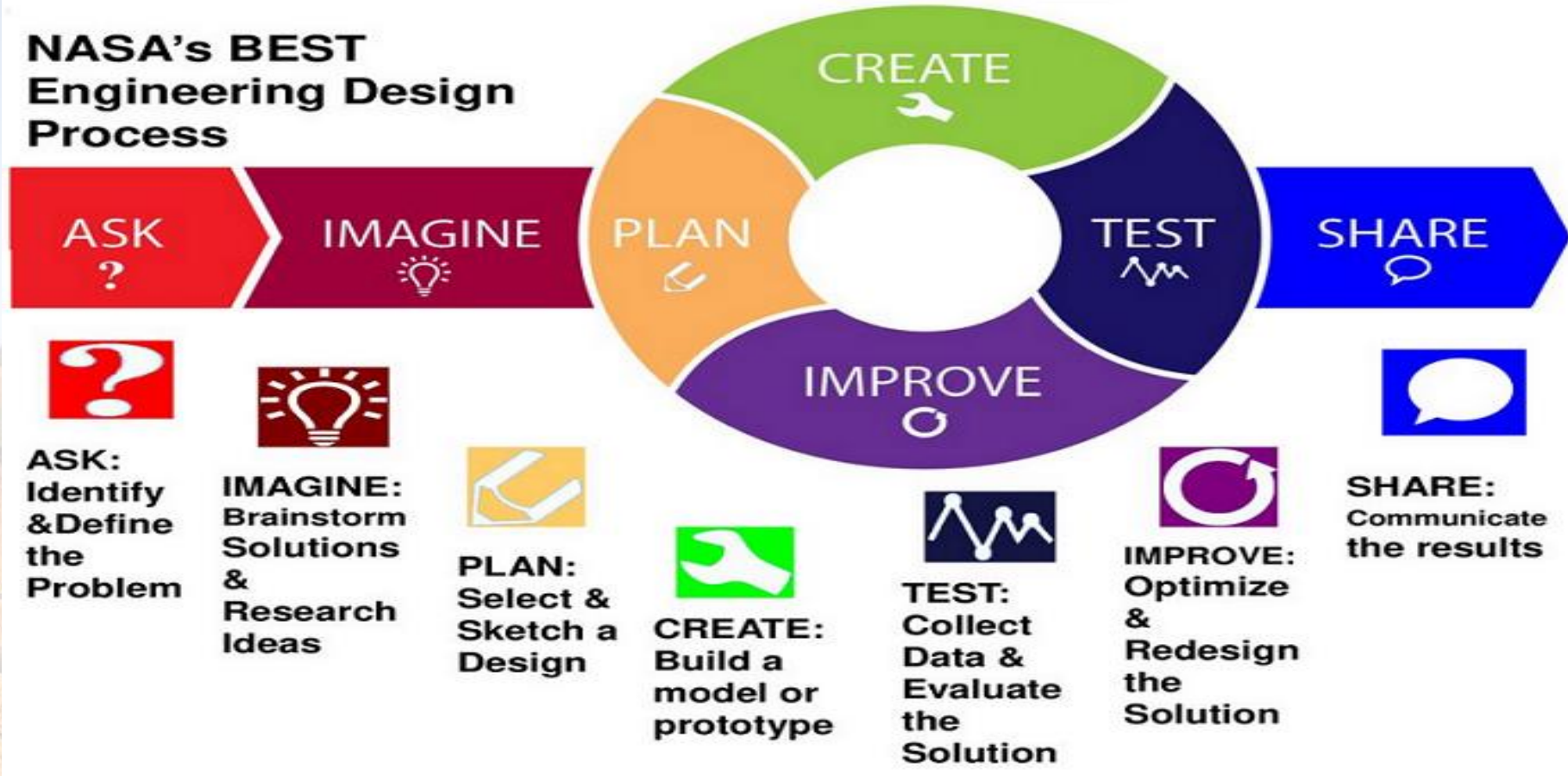
Lesson Objectives

- SWBAT discuss and determine how soil erosion impacts the environment and people.
- SWBAT write a hypothesis that predicts which material will create the most resistance against erosion.
- SWBAT create crust using different materials such as glue, corn starch, playdough, vegetation, EICP etc.
- SWBAT compare the efficiency and sustainability of their crust and discuss the pros and cons of each soil cover.

RET Instructional Lesson Implementation

Lesson Description: Engineering process

NASA's BEST Engineering Design Process



RET Instructional Lesson Implementation

Lesson Description: Engage/ Ask

In this lesson we will explore how we can strengthen the soil and control soil erosion. Let's start with why we need to protect soil. Here is a video that gives us some insight.

<https://www.youtube.com/watch?v=ETRK0tUKMjA>

RET Instructional Lesson Implementation

Lesson Description: Explain/ Imagine

Question - What are some of the effective ways to create a crust on the soil that will make it strong and resist the erosion?

1. [Erosion Powerpoint](#)
2. Students will conduct research in groups and find some ways of protecting soil.
3. Each group will present their findings by writing a proposal.

RET Instructional Lesson Implementation

Lesson Description: Explore/ Plan and create

Question - What are some of the effective ways to create a crust on the soil that will make it strong and resist the erosion

Lab 1- Create a solution

Students will be divided into teams and each team will create a solution to create a soil crust.

Teams are :Team water, Team vegetation, Team EICP, Team Cornstarch, Team Glue.

RET Instructional Lesson Implementation

Lesson Description: Explore/ Test

Question - Which solution makes the strongest crust?

[Lab 2- Strength Test](#)

Student Teams will test the strength of their treated sample against an untreated sample using 2 out of the 3 tests:

- Penetrometer (crust strength)
- Hair dryer (wind resistance)
- Nasco soil erosion kit (water resistance)

RET Instructional Lesson Implementation

Lesson Description: Elaborate

Question - Are your solutions really practical?
Sustainable? Economical?

Whole class discussion- What are some of the other factors that make a solution good or bad?

Students will rate each of the solutions on cost, sustainability, and effectiveness.

RET Instructional Lesson Implementation

Lesson Description: Evaluation/ Assessment

Writing activity-I think _____ is
the best solution because _____

Quiz- What did you learn?

<https://quizizz.com/embed/quiz/649b618fd8c949001dae20c2>

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Questions?

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