Watershed Engineering Design Challenge

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GRADE LEVEL

6
7
8

CONTENT TOPICS

Earth Science
Environmental Science
Science

DESCRIPTION

This lesson includes a three day plan for a water cycle activity that uses the engineering design process and explores the driving question: To what extent can precipitation be effectively diverted (collected and used)? Activities include unpacking prior knowledge, student research, a design project, formative assessment, and a field trip.

SUGGESTED STANDARDS CONNECTIONS

NGSS	MS-ESS2 Earth's Systems MS-ESS3 Earth and Human Activity

Aiea Intermediate School
Sample Lesson Plan (for RET)

Lessons and activities prior to this lesson:

1. *Concept: water cycle, watershed, ahupua'a*
2. *Field trip to Nu'uanu Watershed #4 (BWS); follow up discussion/debrief*
3. *Water quality – indicators of health level of streams, testing protocols, data collection*
4. *Field test – on-site water quality tests, observations; analysis of data*
5. *Google Earth virtual "stream tracking" – contributing factors to stream water quality*

LESSON PLAN

BENCHMARKS addressed

- SC.7.1.3: Explain the need to revise conclusions and explanations based on new scientific evidence
- SC.7.2.1: Explain the use of reliable print and electronic sources to provide scientific information and evidence

Review: What happens to precipitation?
Listen for the following terms with their explanations: run-off, percolation, evaporation, condensation, pollution (source, non-point source)

DRIVING QUESTION: To what extent can precipitation be effectively diverted (collected and used)?

Activities – Day 1

1. With a partner, students research "water catchment" – definitions, examples, designs, uses, systems (commercial, pre-fabricated, DIY versions, etc.); pairs should take reference notes, including sketches
2. Using reference notes, pairs need to:
    a. Develop a list of "must haves" for a system
    b. Make a labeled sketch of a system with explanations of how the "must haves" are addressed
    c. Explanation of how the water in the system will be used and accessed
3. Have each pair briefly share their design sketch and explanatory notes with the whole group
4. Whole class: Compare the "must haves" that came from each group. What are the similarities? Are there differences? Discuss the significance of each.
5. Homework: Collect "building supplies"
    a. The facilitator will provide: scissors, and a limited supply of glue, tape, construction paper, lightweight poster board for each group
    b. Each member of the group/pair must bring in remainder of supplies – RULE: no purchased goods for the project; all items must be "scrap" materials (Allow time for the group members to discuss possible materials that might be appropriate for the build and who will be responsible for bringing in what elements. Facilitators should discuss "alternate" materials during the problem solving process.)

Activities – Day 2

Set up work areas. Review ideas of "conservation" and "wise use of resources" in general and how they pertain to the activity. Using their sketches as a guide, pairs are to use provided and collected materials to construct a 3D model of the catchment system they designed. If modifications are made from the original design, they

should make notes as to what they were and why they were implemented. (Optional documentation: have pairs or facilitator take photos of construction progress during different phases.)

Activities – Day 3

Group presentations of 3D models – include brief review of design and function; explain any modifications that were made in the construction phase.

(Variation: Change the type of materials provided and allow for additional construction time. Test structures/ systems to see if they hold and expel water as intended.)

REVIEW and RESPOND to Driving Question: Have pairs evaluate their product by using it as an example of a response to the driving question. Have them assess how effectively the system collects water and makes use of what is collected; also, have them comment on how the system can be improved.

PREPARATION for follow up activity: So, what happens to the water that you use (goes down the drain)?

- *Field trip to Honouliuli Wastewater Treatment Facility*