Modeling the Solution (Scenario A: Learning Experience #2)
Lesson Plan

Summary

Student groups will choose one environmental factor that has contributed to the degradation of Smith Creek and test their proposed solution to that problem using a model that can be carried out in the classroom or on school grounds.

Essential Questions

- How could a rural county restore and maintain a reproducing population of brook trout in a local stream?
- How could a scientist try out an idea before performing a full-scale experiment?

Objectives

The students will:

- work productively as a part of a project team.
- design a model to test a chosen method of stream restoration.
- collect data using appropriate tools and record results in data tables.
- analyze results using graphs.
- summarize results and come to a conclusion based on data.
- describe their proposal, protocol, results and conclusion to classmates.
- keep accurate, complete records in a journal.

Materials for *Modeling the Solution* (LE#2)

- *One packet per group containing one copy each of the following materials:*
    - *Test Protocol* (Student Sheet #1)
    - *DataTable/Graph* (Student Sheet #2)- will need two per group
    - *Test Summary* (Student Sheet #3)
    - Student Procedures for *Modeling the Solution* Learning Experience

Materials for *Modeling the Solution* (LE#2), continued

- Notebooks or small binders or folders to be used as journals, one (1) for each student
- Rulers for data tables and graphs
- Chart paper and markers
- Buckets, graduated cylinders, trays (9"x13" foil pans or cookie sheets), soil, squares of grass sod, small rooted plants including tree seedlings if available, liquid fertilizer, cloth, shade cover or black construction paper, rectangular 10 gallon aquarium, lamp with incandescent bulb
- Data gathering tools for measuring turbidity, mass of sediment, temperature, nitrate levels, phosphate levels, dissolved oxygen levels, temperature.

Grade Level: 8-12

Subject Areas
Environmental science, biology, math, language arts

Timeline
Teacher preparation: 30-45 minutes
Learning Experience: 90 minutes

Setting
Classroom lab or school grounds

Skills
Design test of a hypothesis, choose appropriate materials, design data tables, accurately collect data, organize data in tables and graphs, summarize results based on data, and communicate all procedures/ results to team and classmates

Vocabulary
Habitat degradation, habitat restoration, hypothesis, model, protocol

Advance Preparation Required

Make copies of the student sheets listed for each project team. Provide chart paper and markers or access to technology that will allow students to present their ideas and results to their classmates.

Collect the materials listed for the lab tests, several of each item if possible, and put them on a table for the students to review before they design their protocols. This will provide teams with ideas to consider as groups decide how they will tests their hypotheses. You may also ask them if there is something missing (within reason) that you or they could provide.

Procedure

1. Introduce this learning experience by asking students to review their team's plans for restoring the trout stream. They should choose one of their proposals to test in the classroom lab or on the school grounds. Your students will model their planned solutions by designing a test that will answer one of these questions, or they may suggest a question of their own:
    - Does the presence or amount of vegetation affect the amount of sediment running off a slope?
    - Does the kind of vegetation make a difference in the amount of sediment running off a slope?
    - Does the presence or amount of vegetation affect the amount of fertilizer running off a slope?
    - Does the angle of the slope affect the rate of erosion?
    - Does the presence or amount of shade affect the temperature of water?
    - Do trout have a water temperature preference? Amount of light preference? Contact representatives of Trout Unlimited and ask them if there is a local chapter that could bring an aquarium with live trout to your classroom for a few days. Their web site is http://www.tu.org.

2. Have the teams check in with you as they choose a question and design a test. Each team should be working on a different question, if possible.

3. Ask student teams to discuss and fill in the first part of the *Test Protocol* sheet: Question, Hypothesis, Prediction and Procedure. Remind them to run several trials (at least 3) and identify their variables, changing only one variable with each trial.

4. The teams will design a data table that clearly identifies their variables and has space for recording the results from each of their trials, plus their calculation of the mean. The title should indicate what they are testing. They should fill out the *Data Table/Graph* sheets before they begin their tests.

5. Now students are ready to test their hypotheses. One team member should act as equipment manager and another should collect and record data. The remaining member(s) will run the trials. Data will be recorded in the table(s) that the team has designed for this test. The record of the experiment should include a drawing of the setup and apparatus used.

6. Teams will design and complete a graph, which is a picture of their data.

7. Students now return to their *Test Protocol* sheet. Did their results match their predictions? Their conclusion should be a statement about whether or not they supported their hypothesis with the data collected. They should include a statement about how this test will affect their plans for restoration of the stream.

8. Each team will present its test procedure and results to the class, including an explanation of their materials, the protocol followed, and their decision about the restoration project based on the test.