



Using Structured Inquiry to Teach Environmental Science

Objective: To teach students about effects of pollution on ecosystems using structured inquiry.

Setting and Materials:

Settings: General education classroom

Materials: Students were from “Ecosystems” unit of the Science and Technology for Children (1992) curriculum. These included: the teacher manual; student activity booklets; three, 2-liter plastic bottles; soil; mustard seeds; alfalfa seeds; grass seeds; small stones; organic matter; isopods; crickets; water; gravel; elodea; duckweed; guppies; snails; vinegar; salt; fertilizer; vinegar; salt; and plant fertilizer.

Content Taught

Students were taught to analyze and understand the effects of pollution on an ecosystem. This included factual (e.g., what is a consumer?) and conceptual understanding (e.g., now that you’ve studied one type of ecosystem, what do you think the living and nonliving parts of a another ecosystem would be?).

Teaching Procedures

1. Arrange students into groups of 2-3 students
2. Present each group with three, 2-liter plastic bottles cut to fit together to form one large container. Bottles should be cut in the following manner:
 - i. Cut the top off of one, turn it upside down, and place a nylon screen at the bottom
 - ii. Cut the top off of another
 - iii. Cut the top and bottom off the third.
3. Have students create a terrarium with bottle A by: add soil; plant mustard, alfalfa, and grass seeds; add small stones, organic matter, isopods, and crickets; and cover with the plastic bottom from another bottle.
4. Have students create an aquarium with bottle B by: partially filling with water, adding gravel to the bottom, planting the elodea and duckweed, and finally adding guppies and snails.
5. Have students use bottle C as a sleeve to connect the terrarium (bottle A) and the aquarium (bottle B) with the terrarium on top and the aquarium on the bottom.
6. After completing the “Ecocolumns,” have the groups pair off.

7. Have the paired groups choose one of their ecocolumns as the experimental and the other as the control.
8. Groups decide how to interfere with one of the ecocolumns by adding (a) a weak vinegar solution simulating acid rain, (b) a salt solution simulating road salt, or (c) a fertilizer solution simulating excessive fertilizer. Pond water will be added to the control ecocolumn.
9. Groups should determine the strength of the chosen solution, how often to add the solution and the pond water to the ecocolumns.
10. Have students predict the effects of the solution and pond water on the respective ecocolumns.
11. Students add solution and pond water according to the schedule for 3-weeks, recording the results.

Evaluation

1. 20-question multiple-choice questions on Ecosystems based on the textbook.
2. 10-question test to assess conceptual understanding. This assessment included some open-ended questions (e.g., tell everything you know about ecosystems) and some items requiring students to produce diagrams of the concepts (e.g., draw an ecosystem and label all parts).

Lesson Plan Based on:

Mastropieri, M. A., Scruggs, T. E., Mantzicopoulos, P., Sturgeon, A., Goodwin, L., & Chung, S. (1998). "A place where living things affect and depend on each other": Qualitative and quantitative outcomes associated with inclusive science teaching. *Science Education*, 82, 163– 179.

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