WHERE WOULD LIZARDS BE WITHOUT PLANTS?

An Elementary Science Lesson Plan
Designed for Group Inquiry
Based on the 5E Inquiry Model

GRADE LEVEL: This lesson is intended for a 4th grade classroom.

SCIENCE CONCEPT: The main idea of this lesson is that plants are organisms, and like all organisms they need energy and matter to live and grow. Students will develop their own experiment in response to the question, "How much water is enough for healthy plant growth?" This lesson can follow previous lessons on the central role that plants play in the food chain. This lesson is a Level 3 guided inquiry as defined by the four-level model of inquiry instruction (Bell, Smetana & Binns, 2005).

RELATIONSHIP TO THE CALIFORNIA SCIENCE CONTENT STANDARDS

4th Grade Life Sciences:

2. All organisms need energy and matter to live and grow. As a basis for understanding this concept, students know:
    a. Plants are the primary source of matter and energy entering most food chains.

LEARNING OBJECTIVE: Students will design an experiment to answer the question, "How much water is enough for healthy plant growth?"

EVALUATION IDEAS:

1. Formative: Review student experiment steps on the Experiment Worksheet before they begin their experiment. Review student observations on the Observation Record as the experiment progresses to assess how students are collecting their data.
2. Summative: Assess student Experiment Worksheets based on the Experiment Rubric.

CONCEPTUAL BACKGROUND

All organisms have needs. To live and grow a plant needs light, air and water, nutrients and adequate space. Plants get their energy from the sun. During the process of photosynthesis, green plants use energy from sunlight to change carbon dioxide and water into food and oxygen. Plants use the energy from the food they make to live and grow. When animals eat plants, both energy and matter are passed to other living things as part of food chains.

As described by Project Learning Tree (2012, Activity 41), water is essential to plants for several reasons. Water is a primary element of protoplasm, the basic material that comprises the plant's structure, along with being a main ingredient for photosynthesis. Water also helps transport nutrients from the soil to the plant's roots.

In this activity, students design an experiment to test how much water is enough for healthy plant growth. It is important to clarify to students that a scientific experiment must have a control group and an experimental group. The control group should be kept under normal conditions (e.g., water, light, soil, etc). The experimental group is kept under normal conditions except for the one variable being tested (e.g, water).

LESSON IMPLEMENTATION PLAN

ENGAGE: Ask students how much water do you think you drink every day? How much do you think you need each day? How much water do you think a plant needs to grow in a healthy way? How could you find out?

EXPLORE: Organize students into groups of three. Have student teams devise experiments to answer the question "How much water is enough for healthy plant growth?" Before teams begin working ask the class the following guiding questions to help them think through designing their experiments:

What will be different for each of the plants? (how much it is watered) What should be kept the same for each of the plants? (location, kind of soil, size of pot, etc.) What will you observe? (the way the plant looks, how tall it is, what the leaves look like, etc.) How often will you make observations? How will you measure and summarize your observations?

Handout the Experiment Worksheet. As students begin to work, move from team to team to make sure the experiment steps are clear. Ask students questions to clarify their experiment steps as needed.

EXPLAIN: Have student teams report their findings to the class. They should present some kind of visual summarizing their experiment observations. How do the conditions of the plants differ? Which one seems the healthiest? What is your evidence?

ELABORATE: Do a second experiment testing another variable that plants need to survive. In the second experiment have student groups decide what they want to test and develop the research question.

EVALUATE:

(a) Formative: Review student experiment steps on the Experiment Worksheet before they begin their experiment. Review student observations on the Observation Record as the experiment progresses to assess how students are collecting their data.
(b) Summative: Assess student Experiment Worksheets based on the Experiment Rubric.

DIFFERENTIATION PLANS

Behavioral for Student A: For the inattentive student, it will be helpful to group them with students who do not create unnecessary distractions. Have frequent student contact and

provide feedback often. Remind the student about the class behavior reward system. Give them a break if needed.

Cognitive for Student B: For a student with lower cognitive skills, check for understanding on the Experiment Worksheet vocabulary. Do a think aloud with them on testing a different variable to help model the experiment steps. Check periodically on the student's progress in measuring and recording observations.

Cognitive for Student C: For students with higher cognitive skills, ask probing questions about why they chose that prediction on their Experiment Worksheet. Encourage more sophisticated ways of recording and summarizing their observations - maybe photographs or using a spreadsheet program to graph plant height.

Affective for Student D: For a student who needs more emotional support, it may be a good idea to send the Experiment Worksheet home the day before the assignment so they have a chance to review the questions at their own pace and know what to expect for the classroom work. Have frequent student contact and provide feedback often.

Language Demands for Students E, F, G: A word wall with word cards for key vocabulary (e.g., research, prediction, experiment and observation) can be used for all students with limited English language skills. These key word cards would provide a simple definition of the word, a related image and a sentence example. Check for understanding on the Experiment Worksheet. Monitor progress on measuring and recording observations. Make sure that not all students with limited English language skills are placed in the same group.

MATERIALS

- Young bean or radish plants
- Milk cartons or plastic cups
- Graduated cylinders or measuring cups

Lesson adapted from "How Much Water is Enough for Healthy Plant Growth?" (Bass, Contant & Carin, 2005, A-145).

SUGGESTED READINGS

Bell, R.L., Smetana, L. & Binns, I. (2005, October). Simplifying Inquiry Instruction: Assessing the Inquiry Level of Classroom Activities. *The Science Teacher*, 30-33.

This article discusses the meaning of inquiry instruction and provides a helpful overview for understanding the four-level model of inquiry. These levels range based on how much information is given to the student. In a Level 3 activity (guided inquiry) the teacher presents the research question, but the methods and solution are left up to the student. This article provides examples to help understand the differences between the levels.

Kudlinski, K. V. (2003). *How Plants Survive*. Broomhall, PA. Chelsea Clubhouse.

Plants may look like they have it pretty easy, but this book does a good job of describing how a plant's life is really a constant struggle. While the chapters are a little long, some of the titles (The Great Plant Contest, Water Wars, New Battlegrounds, etc.) may capture students' attention and make them think a little differently about plants.

Team Members _____ _____ _____

Experiment Worksheet

Research Question	
Experiment Steps	
Our Prediction	
Summary of Observations	
What we concluded	

Observation Record

Experiment Rubric

Student Name _____

Task	Excellent	Satisfactory	Needs Improvement
Research Question	Asks a question that can be investigated.	Asks a question that is difficult to investigate.	Question is not clear or cannot be investigated. Or does not provide a question.
Prediction	Makes a thoughtful prediction.	Prediction is not very thoughtful.	Prediction is not clear or relevant or does not provide a prediction.
Plans Experiment	Clearly describes steps of experiment. Steps are logical and lead to evidence in support of the research question. Experiment includes control and experimental group.	Describes steps of experiment. Experiment steps and evidence in support of the research question are not completely clear Experiment's control and experimental group are not completely clear.	Steps of experiment are not clear or they are absent. Steps do not lead to evidence in support of research question. Experiment does not include a control and experimental group.
Conducts Experiment	Carries out and records observations carefully. Takes steps to make sure observations are correct. Works very cooperatively with team members.	Carries out and records some observations. Makes little effort to ensure observations are correct Works satisfactorily with team members.	Incomplete observations. Does not work cooperatively with team members.
Conclusions	Summarizes conclusions in a very clear manner. Gives conclusion consistent with observations. Explains basis for conclusion	Summarizes conclusions. Conclusion not completely consistent with observations. Provides little basis for conclusion	Incomplete, incoherent or missing conclusion. Conclusion is mission or inconsistent with observations. Does not explain basis for conclusion