Environmental Science Institute
THE UNIVERSITY OF TEXAS AT AUSTIN

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Design Your Plant: Exploring Form and Function

By: Laura Sanders, Environmental Science Institute, February 2011

RESOURCES:
Laura Sanders, December 2009 http://www.greenseedling.com/teaching-resources/structure-function/ and Sharon Janulaw, May 2004 http://www.ucmp.berkeley.edu/education/lessons/form_and_function.html
Discussion of Adaptation online: http://evolution.berkeley.edu/evosite/evo101/IIIE5Adaptation.shtml

SAMPLE TEKS ADDRESSED (Grades K-5):
§112.11. Science, Kindergarten, Beginning with School Year 2010-2011: 1B, 3A, 3B, 4B, 10A, 10B
§112.12. Science, Grade 1, Beginning with School Year 2010-2011: 1B, 2A, 3A, 9A, 10A, 10B
§112.13. Science, Grade 2, Beginning with School Year 2010-2011: 1B, 2A, 3A, 3B, 10A, 10B
§112.14. Science, Grade 3, Beginning with School Year 2010-2011: 1B, 2F, 3C, 10A, 10B
§112.15. Science, Grade 4, Beginning with School Year 2010-2011: 1B, 2F, 3C, 10A
§112.16. Science, Grade 5, Beginning with School Year 2010-2011: 1B, 2F, 3C, 10A, 10B

SAMPLE OBJECTIVES:
Kindergarten – Students should make observations about leaves, roots, stems, flowers, and identify parts that, when separated from the whole, may result in the part or whole not working (such as plants without roots).
First Grade – Students should observe and describe parts of plants, and identify parts that, when put together, can do things they cannot do by themselves.
Second Grade – Students should observe and record the functions of plant parts, and manipulate, predict and identify parts that, when separated from the whole, may result in the part or whole not working (such as plants without leaves).
Third Grade – Students should observe and identify that a sprouted seed is a simple system and describe the role of the various parts. Students should analyze how adaptive characteristics help individuals within a species to survive and reproduce.
Fifth Grade – Students should describe and compare traits that are inherited from parent to offspring in plants and give examples of learned characteristics that result from the influence of the environment.

CONCEPTS:
Physical features and behavioral traits can often be linked to their functions. Survival is dependent on structures and their functions (natural selection). Structures include any parts conspicuously identifiable by the young child and functions could include food acquisition (capturing and eating), waste disposal, gas exchange (air/breathing), protection, reproduction (making baby plants, etc.), locomotion (running, crawling, flying). Students should record all observations and data in science journals.

- Form is linked to function.
- Plants and animals have features that allow them to live in various environments.

MATERIALS:
Engagement - Plants and animals in appropriate containers, or pictures of plants and animals, set up in stations around the classroom. Students should be arranged in compatible groups of four.
Exploration –Two plants of the same species (small, cheap selections from local store will do) for each group of four students and small cups or pots (type doesn't matter) to plant them in, as well as some extra soil.

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Elaboration and Evaluation – Students may record their designs in their science journals, one personal sheets of paper for display, or on large paper for group efforts. Colors and legible labels make these visually appealing. For "Design a Plant," various recyclable materials are perfect for constructing their creations, and enhance the idea of sustainability.

PROCEDURE:

Engagement:

1. Hold up a plant. Ask students what parts they notice. Select a part and ask how the part helps the plant live. Discuss.
2. Tell the students that they are going to move about the room in their groups to look at living things. They are to choose a part (structure) of each living thing and talk about how that part helps the plant or animal survive.
3. Send the groups to their starting stations and give them a few minutes to identify a part and determine how it helps the living thing survive. Circulate to reinforce the purpose of the lesson. Students should make a table in their science journals to record structures and functions and observations.
4. After all groups have rotated through each station, ask each group to tell about a part and a function at their last station. Allow other groups to share what they noticed at that station.
5. To review and sum up, select a few sample parts and ask the class the function of each.

Exploration:

1. Conduct an experiment to find out if plants can survive without roots, and to explore root function.
2. Pull two similar plants out of the soil and cut off the roots of one of them. Replant both and water them. Treat both plants in an identical fashion for a number of days and compare how each looks.
3. After a week or so, ask students what they observed and what they think is the explanation for their observations.
4. Possible questions to discuss include: Were both plants able to stay upright in their soil or pot? How did the leaves or stem change? How did the soils compare? This should establish that roots function to anchor a plant, as well as supply water and nutrients. Variations can also be done on this theme, such as one plant being watered through the soil, while the other being watered only by spraying the leaves.
5. Perhaps students could construct their own experiment in place of this one and choose which variable will remain constant and which variables they will test to explore structure and function of the plant parts.

Elaboration and Evaluation:

- **What if your house was made of plants?(Ages 6-13)** Modifications can be made to this question based on plant knowledge of students. Older students may go into more detail about naming specific plants used, while younger students may choose parts of vascular plants to make up their homes.
    1. Describe what plants would make the floors, walls, roof, furniture, etc, and why you chose those plants.
    2. Draw a picture of your plant house.
    3. What parts of your current home are made from plants?

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- **Design a Plant (Ages 9-13)**
  Modification opportunities abound with this fun experience. It can also be made as large and complex or simple as needed. GREAT for a display or show to demonstrate what has been learned.
  1. Design a plant of your own creation and name it as a scientist would. Draw a picture of your plant or construct a model of it. Remember to think about what functions it will have in the design (does it need to attract pollinators, or need a strong root system, etc.).
  2. Design a seed for your plant. Consider what type of seed dispersal your seed will use. Build a model of your seed using recycled materials (example – an old button becomes a wheel that helps the seed role away from the parent plant, or old feathers on cotton balls from a craft box help the seed to float away on a breeze).
  3. Design a seed packet. This packet needs to be attractive to customers so they will want to buy your seed and plant it in their garden. It also needs to explain on the back how the seed needs to be planted. Consider amount of sunlight, type of soil and depth in the soil, water needs, etc.