Beans Investigation in Elaboration Phase

Materials, Preparation, Safety (See Internet Resources for sources of materials).

- Seed packets of green, yellow, and purple *bush* beans (or you can purchase one "Trilogy" packet); one variety of pole beans. (See Seeds, Internet Resources)
- Container such as an EarthBox® and potting soil such as WonderSoil®.
- Fluorescent lights (with tube covers!)--color temperature of 5000 or 6500 K--for germinating/growing plants indoors (see Grow Lights, Internet Resources). If 60 days of warm weather remains, all growing can be done outdoors assuming you have an area that receives $\geq$ 6 hours of full sun and is fenced off to prevent damage by animals.
- Material to build a trellis (e.g., bamboo poles and string; see also EarthBox.com).
- Student journals (to record questions, predictions, observations; provide explanations)
- Be aware of and follow safety precautions (see "Safety Tips").

Procedures

1. Connect this phase to previous phases by discussing stages of corn and sunflower growth as well as the variety of sunflowers. Announce that will grow beans in class to observe stages of growth and learn more about plants (structures, variety).
2. With students, identify focus questions to "drive" the elaboration. Examples:
    a. How long will it take each type of seed to germinate?
    b. How will our plants look in 7, 14 (etc.) days?
    c. In what ways will the plants that grow from the seeds be similar and different?
    d. Why will there be some differences in the plants that grow from the seeds?

3. Relative to the focus questions, have students make predictions (including drawings) in their science journals and share their predictions.
4. Plant the seeds following directions on the seed packets (and instructions for the growing container being used). Keep the soil surface moist until the seeds germinate.
5. As the bean plants grow, have students observe and journal about ways in which they look the same and different. Students should observe that the pole beans grow taller than the bush beans, and that the fruits that emerge from the bush beans are different in color and in other ways. Compare observations to predictions.
6. During the growth process of the pole beans, students will observe a problem: The vines will sprawl onto the floor and try to latch onto anything. Troubleshoot with the students towards the solution of "growing up, not out" and the use of vertical supports. Show GigaPan of pole bean teepees (http://www.gigapan.com/gigapans/176851); build/install a trellis of some sort. As students observe the vines twining around and growing up the trellis, ask students if there is anything we can learn from this to solve any problems that humans face (e.g., shortage of land to park and live--build elevated parking garage and skyscraper; build bridges to move from one place to another).
7. Use question/answer dialogue as a means to develop the understanding that beans are one type of plant but there are different varieties of a bean plant. Each variety has different traits (like green, yellow, and purple color), and these traits are passed on from their parents (e.g., like eye and hair color is passed from parents to their children.)
8. Integrate mathematics throughout, e.g., count and measure seedlings and bean pods.

9. When the fruits (bean pods) emerge from the bush beans, remove a seed from the pod of each different variety of bush bean and have students vote: If we plant each seed, what color will beans be that grow on each of these bean plants? Why?
10. Summarize by returning to and reviewing answers to the focus questions.