

Inquiry Lesson: Flower Power!

I. Lesson Summary: Students will compare various germination stages of bean seeds and analyze the different growth stages of flowers found together on a bush bean plant.

II. Goal: Flowers Are for Reproduction. Students will recognize that the purpose of a flower is to reproduce a plant.

III. Duration: This lesson will be on going for approximately 3 weeks. Students will need 10 days to ready their bean plants for progression observations. The final week will be used to analyze and synthesize observations of the bush bean plant.

IV. Specific Learning Objectives:

A. Content Objectives:

1. Seeds contain plant embryos.
2. Embryos grow into plants.
3. Flowers produce fruits.
4. Fruits have seeds.

B. Process Objectives:

1. Recording skills. Students will keep a data notebook. I stapled together 5 x 7 size index cards together. These worked out just fine.
2. Apply previous knowledge. The presence of seeds in different foods indicates that they were derived from flower parts. This was a day spent dissecting different fruits from the super market.
3. Diagramming/sketching skills. Drawings will be included in the data notebook. We sketched the flower parts and the bean cross-section.

V. Pre-requisite Knowledge/Skills for Students:

1. Observation skills.
2. Familiarity with dissecting microscope use.
3. Practice with charting data, diagramming, and sketching.

VI. Background information:

1. Students will be looking at stages of sprouting bean seeds.
2. Students will be looking at the growth stages of: flower->fruit->seed on the bean plant.
3. Bush bean (not pole bean) seeds will purchased and planted in pots.
4. Daily or every-other-day observations will be made and recorded in the data notebook as the students recognize changes in sprouting beans.

5. Make dissecting tools available as students get curious about what is inside their beans or inside the flowers and pods of the bean plant.
6. Provide feedback. Give explanations for observations.

VII. Preparation for Lesson:

A. Materials Required:

- 1 potted bush bean plant per group of 4 students.
- 10 bean seeds per student.
- Dissecting microscopes or hand held magnifying lenses.
Microscopes are better.
- Dissecting tools. Tweezers, probes and a sharp scalpel.
- Data notebooks.
- Zip-loc baggies. Use gallon size baggies. Sandwich size baggies will be quickly outgrown.
- Paper towels.

B. Preparation of Materials:

1. Plant beans in pots 6-8 weeks prior to the beginning of the lesson. (I planted mine the last week of July.) Plants will need to be in flower and producing beans by the middle of September.
2. Cut paper towels to the same size as the zip-loc baggies. Label baggie with student's name. Place paper towels inside. Soak paper towels. Add 2 beans on the top of the paper towel, keeping it visible from the outside of the baggie. Zip closed. Do this every other day until each student has 5 sets of sprouts prepared.
3. Keep bean plants fresh and watered.
4. Keep bean sprouts in baggies moist. (By the 6th day, we had bean sprouts growing out of the baggies. Students planted older sprouts into saved milk cartons. I brought in potting soil.)

VIII. Instructional Strategy:

A. Engagement:

Ask students if they see any flowers outside the classroom window. Or, do they have flowerbeds planted around the house? Do any of the crops planted in the fields have flowers? Where? Show cut out pictures of "traditional" flowers, i.e. Roses, daisies, tulips. Ask, are these flowers? Then show pictures of "untraditional flowers", i.e., apple blossoms, dandelions, corn, wheat. Ask, are these flowers? Bring in some samples of different flowers, i.e., catkins, cattail, poinsettia, carnations, hollyhocks. Again, ask students to identify whether or not they are flowers. What are flowers? Let's find out!

B. Exploration:

Students will begin discovering changes in the bean sprout baggies within a few days. They will record data in a chart or table. Example: date beans placed in baggie, date sprouted, length measurements, when water was added, observations of physical changes, sketches of plant structures that appear. The third and final week of the

inquiry will be to synthesize what is learned from the bean sprout activity into the bean plant observation. (They have figured out that seeds contain baby plants.) Now, they will be directed to discover that fruits contain seeds and flowers produce fruits.

C. Discussion/Explanation:

Teacher will encourage exploration with guided questions and notations in student notebooks. Walk around and check on growth stages of each student's bean sprouts, asking them what they see. Encourage some dissection. What do they see inside the bean? What do they think is happening? What did they have in the beginning of the experiment, and what do they have now? During the last week, students will need direction in discovering that fruits are produced from flowers, and seeds are found in fruits. Ask, What growth stages do you see on the bean plant? Have students pluck off several stages and organize them on the table in a sequential order, first to last. Ask, Why did you arrange them this way? What do you know? What structure appears to contain the seeds? What do you want to call this? Where do you think it comes from?

IX. Inquiry Activity:

A. Seeds contain plant embryos.

1. Soak bean seeds on moist paper towels inside zip-loc baggies until they germinate. Soak 2 beans per student every other day for 10 days. This creates a progression of 5 germinating seedlings.
2. Teacher 3 x 5 card says: Seeds contain plant embryos. (Baby plants is acceptable.)
3. Students record their observations in a data notebook. Teacher makes notations and asks questions. What do they know? How do they know it? What is the purpose of the seed? What does the seed contain?

B. Flowers produce fruits.

1. Teacher 3 x 5 card says: Flowers produce fruits. Direct student attention to the flower of the bush bean plant.
2. Students will make observation of flowers. They will record data, draw sketches of flower parts. Encourage dissection and investigation of internal structures. Compare drawings with another student. What common structures are there in the drawings? What might their function be? Why do you think so? Do all of the flowers seem to be in the same stage of development? Why? Why not? Compare developmental stages. What do the flowers appear to contain?

C. Fruits have seeds.

1. Show students bush bean plants. Direct their attention to the bean pods.
2. Teacher 3 x 5 card says: Fruits have seeds.
3. Students will make observations. Draw pictures of bean pod parts as seen with a dissecting microscope or hand lens. What is the pod? From where do the pods appear to have come? What are the structures on the inside of the pod?

How are the structures inside the pod similar to the beans that you sprouted?
What can you say about pods?

X. Assessment:

Be sure to assess each content objective and each process objective.

Examples of assessment include:

1. Reviewing the data notebook, either during actual activity time or by collecting them.
This will assess process skills.
2. After each activity time, conduct a quiz with 3 x 5 cards. Ask students what they observed. Ask them to state what they know. What is the purpose of a seed? A fruit? A flower? This will assess content.

XI. Comments:

This lesson will probably work best at the beginning of the school year, since flowers will still be readily available outside for observation. The bush bean plants will also need to be started over the summer, approximately 6-8 weeks before planning to introduce the lesson. This ensures that there will be plenty of flowers and fruits.

Extension activities: introducing several types of seeds, fruits and flowers for comparison. I also made a crock pot full of green beans and brought them in for the students to eat. Many fruits are edible!