



Basic Vegetable Gardening

Lesson 7: Conducting Experiments

Lesson Summary: Boys and girls will design an experiment they will carry out in the garden.

Intended Learning Outcomes:

Members will practice the steps to experiments in the garden.

Length: 1 hour for lesson Steps 1-3

1 hour for lesson Steps 5-7 AFTER the experiment is completed.

Materials:

Teachers Manual – has background and several examples of experiments.

6 cards or pieces of paper. Each card should have one of these words or phrases on them: Problem, Hypothesis, Design, Observations, Analysis of Data, Draw Conclusions

Supplies for experiment

Experiment observation chart and records

Background: The previous lesson gave background about experiments in the garden. This lesson will help the boys and girls design an experiment to carry out.

Notes to Trainers:

The trainer should also remember that the purpose of doing experiments is to teach the boys and girls science literacy – how to be scientists. The results of an experiment are not an indication of the trainer’s knowledge.

In some cultures, teachers and other adults feel they must always know the answer to a child’s question. That is not true in conducting experiments. The trainer’s role is to help the boys and girls to think like scientists. Successful scientists ask a lot of questions because they don’t always know the answers to problems.

Trainers may need to control their urge to make the experiment turn out the way the boys and girls predict – to make the hypothesis come true. Try not to influence the boys and girls, or the results of the experiment. Good scientists are unbiased.

Lesson Steps

1. (5 minutes) Introduction

Ask the members to list the six steps to experiments they learned in the recent lesson. Hold up the cards with the steps listed as the students say the steps.

Write them on a chalk board if you are meeting indoors.

Identify a problem (or question)

Develop a hypothesis

Design the experiment

Observation of what is happening – write it down

Analysis of Data

Draw Conclusions



2. (15 minutes) Explain that today they are going to develop an experiment they will conduct over the next few weeks in the school garden.

2.1 (10 minutes) Brainstorm about potential experiment topics that can be done in the garden. The list is endless. Topics can relate to planting, transplanting, watering, making or using compost, crop rotation, fertilizer, harvesting, pest control or others.

Hint to trainer: It is common for boys and girls to question, throughout the season, why they are using particular methods for gardening. These same questions are often good ideas for experiments.

2.2 (5 minutes) Select a topic for an experiment. Use the list from the students to choose a topic. Have the students vote or use another way to involve the students in the decision.

The teacher's manual has several examples of experiments. If the boys and girls list similar topics, you may want to choose one of those from the manual as a guide the first time the group conducts an experiment.

3. (25 minutes) Work through the next 3 steps in the experiment.

3.1 (2 minutes) Problem: Verify the topic for the experiment. Keep it simple.

3.2 (5 minutes) Develop a hypothesis. Be specific. Remember to have a control group or process to make this an experiment. What one thing (factor) will you change to compare to the control group?

Based on what the boys and girls know about scientific theory and about garden science, what do they predict will be different from one group to the next? This is the hypothesis.

Avoid words like "better". Use words that are objective and not biased and can be measured. Some examples include: will weigh more, grows taller, produce more fruit, or will be ready for harvest sooner.

Bad hypothesis: The tomato plants with compost added will grow better.

(This is bad because we don't know what "better" is. How is it measured?)

Good hypothesis: The tomato plants with compost added will yield more fruit.

(This is good because the students can weigh and count the fruit.)

3.3 (10 minutes) Design the experiment.

- Where will you conduct the experiment?
- Is there room for both the control and the experimental group/process right next to each other?
- If you are using plants, how many will you plant in each group?
- How often will you make observations? (Think about how often you can expect to see change.)
- How long should you conduct your experiment? Your hypothesis or problem will determine this. If you are doing an experiment about seed germination, it will take 1-2 weeks. An experiment on making compost will take several weeks.

Remember to keep everything the same in each group or comparison but one factor. If you make more than one change, you won't know what may have caused changes in the outcome.

For example: If we want to see how covering a compost heap affects the decomposition rate of the materials, we need to have one compost heap with a cover. Right next to it, we would make a heap with the exact same materials, but not cover it. The second heap is the "control". EVERYTHING is the same except the cover.

3.4 (15 minutes) Decide how you will make and record your observations.

- What will you measure? How?
- How will you keep track of this data so you can analyze it?

Many student experimenters like to make a chart for recording information. What you write on the chart will depend on the hypothesis. The chart may have a place to write down:

- Name of experiment
- Date of planting
- Date of observation
- Height of each plants and average of all the heights
- Amount of water, compost, fertilizer, etc.

4. **Conduct the experiment.** This step will take place over several weeks. When the experiment is complete, it's time to for the next steps.
5. **(30 minutes) Analyze Data.** Data is all the things you observed and wrote down.

Copy the chart the boys and girls have been using to record observations on the blackboard or another place everyone can see it.

Compare all the data from the experimental group with the control group. Is it different or the same? Why or why not?

6. **(10 minutes) Draw Conclusions** – Using the data, decide if the prediction or hypothesis was proven or not.

Remember that there is no "failed" experiment or data that is wrong. It just is.

As a result of the experiment, what would you conclude?

Experiments usually lead to more questions. Ask the boys and girls what other scientific questions they might have based only on this experiment. Do they wonder if they would get the same results with different kinds of plants? By changing another factor?

Sometimes experiments tell us one method of propagation might have higher yields than another. But then we have to decide if the cost of that is worth it. Or if we have the time or labor. For example, artificial fertilizer may yield more maize than when using cow manure. But the artificial fertilizer may harm the soil. Or the farmer cannot afford to buy it. Therefore, to say one method is “better” than another depends on other factors.

7. (15 minutes) - Summary and Debrief

Summarize by asking:

- What is an experiment? Answer should include mention of a control or comparison.
- Why do we experiment?
- What are the 6 steps to an experiment?
- Can an experiment fail? Answer: No.
- What did you learn about being a scientist by conducting this experiment?
- What did you like best about conducting this experiment? The least?
- How do you think this experiment relates to what you have been learning in the classroom?

Congratulate the boys and girls for becoming scientists!