SEED GERMINATION EXPERIMENT

OBJECTIVES:

To learn what the SCIENTIFIC METHOD is, and how to use to use it to answer a question:

1 To ask a question
2 To hypothesise: guess what the answer is and explain why
3 To devise a method to answer the question
4 To carefully observe and record observations and results
5 To analyse data
6 To draw conclusions and evaluate the effectiveness of the experiment

(1) Begin the lesson by asking the students what they think are the best conditions for seed germination. Let the students brainstorm - encourage them to keep on thinking of more and more different types of possible conditions (they'll come up with light or dark, wet or dry, hot or cold, etc.) I'll tell them that now they will all be scientists, and use the scientific method to find the answer to this question. They should record the experiment as shown on the following pages.

(2) Each student should write what they guess the best conditions are. If they can also explain the reasons for their guesses, that would be good. **Point out that finding out that your hypothesis is wrong is just as good as finding out that it is right.**

(3) The next step is to think of a way to test their hypothesis. Ask the students to orally suggest ways to find out. By asking a few questions, get them to come up with a plan that will be something like what follows. They could choose three variables to test: (1) Water (dry, damp, or underwater); (2) Light or Dark; (3) Temperature (room temperature or fridge). In case the students suggest other variables, those could be used instead, but to keep things simple, not too many variables should be considered. I'll ask the students to figure out how many different combinations of conditions they can get from these variables. Then they should make a Table showing all the possibilities, for example, like **Table 1**.

(4) Divide the class into groups of about 5 students in each group. Distribute enough seeds and containers to each group so that they can use 3 seeds for each condition they want to test (eg 27 seeds for the example shown in Table 1). They should set up the experiment (on Day 0). Each day they should observe the seeds, draw pictures of the seeds, write down their observations, measure the seeds and record their measurements in **Table 2**.

(5) When the observations have been completed, the students should analyse the results and write their conclusions. As part of the conclusions, they should answer the questions on the next page.

(6) Have a class discussion about the experiment.

EVALUATION

The students can be evaluated with a score of 1 to 4 (poor to excellent) on the each of the following:

(1) Did the student participate in group activities and discussions?
(2) Did the student try to predict the results and give logical reasons to support their predictions?
(3) Did the student carefully and systematically record the procedure and results?
(4) Did the student the student reach a logical conclusion based on their own particular results?
(5) How did the student answer the questions after doing the experiment?

Germination Experiment

Question: What are the best conditions for moong seed germination?

Hypothesis:

Materials:

Method:

Table 1: Conditions for Germination

	Water	Light or Dark	Warm or Cold
	none	sunlight	warm
	none	dark	warm
	none	dark	in fridge
	under water	sunlight	warm
	under water	dark	warm
	under water	dark	in fridge
	damp	sunlight	warm
	damp	dark	warm
	damp	dark	in fridge

Results:

Table 2 Drawings and observations of seeds on each day

	Day 0	Day 1	Day 2	Day 3

Conclusions:

Questions:

(1) How many seeds sprouted by Day 1?
(2) How many seeds (in all) had sprouted by Day 2?
(3) How many seeds (in all) had sprouted by Day 3?
(4) How many seeds that did not have water never sprouted?
(5) How many seeds that were underwater never sprouted?
(6) How many seeds that were damp never sprouted?
(7) For the seeds to sprout, was it better to keep them dry, under water, or damp?
(8) For the seeds to sprout, was it better to keep them in the dark, or in the sunlight?
(9) For the seeds to sprout, was it better to keep them in the fridge, or at room temperature?
(10) What are the best conditions for sprouting moong seeds?