<u>Honors Biology Enrichment Project</u> <u>2nd Nine Weeks</u> <u>Design an Experiment to test various variables on Wisconsin Fast</u> <u>Plants</u>

Lesson Summary: Students will design an experiment to test the effect of variables determined by the students on the germination of seeds. The students may test different kinds of water: tap water, distilled water, and stream water; different kinds of light: blue light, sunlight, black light; amount of light: constant, 12 hours of light, 12 hours with out, no light; etc. There are some students who may wish to deprive their seeds of oxygen and some who water their seeds with carbonated water. Some may want to check to see what effect a strobe light or music has on germination. The student may also think of other variables to test. Hopefully students will come up with something amazing to test that I haven't even thought of!

General Goal: I want students to examine the basic conditions necessary for the germination of a Wisconsin Fast Plant Seed. There will also be process goals that will achieved along the way since the students will be required to submit a full lab report by the end of the experiment describing what they found through their experimentation. (This report will not be done in the traditional manner!!)

Duration:

This experiment will occur over a 6 week period of time, but the seeds we will use have an expected germination of 3-4 days. The experiment will be assigned 7 days prior to the actual beginning of the experiment so that the students have time to determine what they want to test and WHY they want to test that variable in regard to germination of a typical seed.

In class time for the experiment will occur as follows:

1-30 minute class period to set up experiment. Plant seeds and application of variables

28 - 15 minute periods at the beginning of class for watering, application of continued variables, measurement of seedlings, etc.

1 – 80 minute class for finalizing of results and clean-up.

Objectives:

1. Students will set up environments similar to what seeds may face in the "real world" for examination over a four week period of time (*ie. drought, excess rain, no nitrogen, contaminated water supply, etc*) to determine their effects on germination. This will be determined by the students, but approved by me before the implementation of the lab. I will direct the inquiry in this regard.

2. Students will show a complete "lab report" stating their question, hypothesis, control, variables, procedures, data table, graphs, conclusion and evaluation. **There will be a formal lab report due by JANUARY 6th**

Prerequisite Knowledge.

Students will begin this activity prior to any class discussions of germination and the needs of seeds. The only prerequisite knowledge or background that the students will have will be what they bring to class from their own gardening experience at their homes.

I am making the assumption that the students have planted a seed in the past, either at their home or in their former science classes....elementary level, etc.

Background Information

After further thought I have decided that the information that follows is not background, but will be given after the inquiry is completed. The only background information the students will have will involve the knowledge they bring with them to class. This will be different for different students because some have had a garden, some have grown things from seeds in former science classes, etc. We will be going through the unit on plants while their plants are growing and they are collecting data. This will hopefully let the students have some insight as to why their plants are "behaving" a certain way as we go along.

Materials required: (provided by teacher)

plastic starter pots potting soil seeds mobile light source rack/plant cart (greenhouse that is not closed in) water different colors of suran wrap miracle grow (any specific fertilizer they want to try I will pick up from Lowe's)

Materials requested/provided by students

The students are in charge of the materials that they need aside from what is listed above.

Maintenance of Organisms

 Plant seeds according to student specifications during day one
Students will be given 15 minutes a day during class for three weeks to water/care for seeds, record growth, and other observations
Students will make final observations.

Engagement

Students will choose the variables for their seed environments themselves for implementation and experimentation

Exploration

The students will design the experiment and explore the effects that their variable will have on the germination of the seed. The students will be involved with the actual design, implementation, recording of results of the experiment on a daily basis for a 6 week period of time. The students will decide how many seeds pots they will use, how many seeds they will put in each pot, the range of pH(for example) that they want to test, etc.

Discussion/Explanation

Students will record their data for the six week period of time to observe the germination of their seeds. The students will also be required to graph their data as part of their "lab report".

Students will show a formal lab report and will be assessed according to the rubric in the following section.

The students should conclude that in order to have a seed germinate, they need to water the seed. The student should also conclude that it doesn't matter what form the water comes in (ie. coke, diet coke, coffee, with lots of nitrogen, little nitrogen, etc) if there's water, it will germinate. This is at least true for the Wisconsin Fast Plants. There are other seeds that require movement through a digestive tract, or burning, etc and that will be discussed later in the unit. The students may also realize that germination and GROWTH are two separate events and that if the seed germinates under certain conditions, it may not GROW under those conditions

Assessment

I will also be assessing their lab reports for the conclusions I mentioned in the above section. This will assess the content they have learned. Students will be responsible for the content learned by the other students. I intend to ask a test question on the unit test regarding germination. The question will be phrased as such: "What are the factors discussed in class that will affect germination?" Students will be expected to answer using data that was presented in class by groups other than their own.

XI. Comments

I think that the main problems involved with this activity will involve how much the students think about WHY they want to test their question. For example, if they want to test the effects of caffeine on plants, they need to examine why this would be important to find out. If they want to test amount of water plants receive, they need to think about why plants might exist in environments with lots of water, little water, etc. There are some real variables that do occur in the "real world" that can be tested and that is where the students need to focus their energy. The students have most likely made observations regarding germination of seeds, (ie. baby trees growing in their gutters, weeds in the garden, dead areas of ground along the side of the road, etc.) If they haven't made these observations, there will be time prior to the implementation of the inquiry activity to try to make some observations and then that that drive their experimentation.