U.S. BIOLOGY TEACHING
Save Time, Engage Students, Love Teaching

# Applying Experimental Design-Mealworms/Superworms

Unit Title: Experimental Design -Mealworms

**Amount of Preparation Needed Prior to Class:** 10-20 minutes

**Lesson Plan:** 6-8 (50 Minute Periods)

**Standard(s):**
**NGSS**
**Practice: Planning and Carrying out an investigation.**

- HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. [Response to stimuli] Note: Unit 1 and 2 are designed to set teachers up for the year. The units review the nature of science and allow for teachers to implement lab expectations while engaging them in the content.

**Objectives**

1.) Students will be able to discover the scientific process.
2.) Students will create a scientific investigation to solve a real world problem.
3.) Students will carry out a scientific investigation and report their findings.
4.) Students will understand the importance of laboratory safety.
5.) Establish procedures for safety and classroom expectations.

**Essential Questions**

1. Why is it important to use the scientific method properly?
2. How can the scientific method help solve real world problems?

**Assessments: Summative and Formative**
(What strategies will be employed? How will we know instruction has been successful?)

1.) Students will complete various worksheets as bell ringers, class work and exit slips.
2.) Students will report their findings in a formal report and/or presentation

**Materials Needed**

1.) Various pieces of common lab equipment used in Biology.
2.) Random supplies for students to build their lab setup. (They can bring in their own supplies)
3.) Mealworm Lab handout
4.) Beach ball (optional) for closing activity
5.) Student names cards- index card with their names on them used to randomly call on students and determine groups for labs and other activities.
6.) Superworms from the pet store
7.) Reserve a computer lab for day 7 and 8 of the lab.

**TIME: 6-8 (50 minute Periods)**-This time frame can be manipulated by assigning

portions for homework or requiring more or less trials during their experimentation

**Bell Ringer/Warm Up/Engagement**

**Day 1-BR**

- On slide 2 of the Lab Equipment Presentation students will complete the bell ringer- "List at least 3 types of lab equipment and explain the function of each."

- Optimize your bell ringers by using an online timer.

**Day 2-BR**

- Students will complete the lab safety bell ringer

**Day 3 –BR**

- Student will complete Analysis of the Experimental Procedure. (Emphasize that you expect their procedures to be much better than that example when they design their experiment.)

**Day 4-BR**

- Students will complete the Experimental Design Scenarios Bell Ringer

**Day 5- BR**

- Have students create two data tables for collecting the data for their experimentation. A quantitative data table and a qualitative data table.

**Day 6-BR**

- Have students create a graph by hand using their quantitative data.

**Exploration/Explanation/Elaboration**

**Lesson 2:**

**DAY 1**

- Set up the lab with the various pieces of equipment list in the **Identifying Lab Equipment** Handout. Number each of the pieces of equipment.
- Using the names cards randomly assign students a start point and have them rotate through the lab to explore each piece of equipment.
- With the last 15 minutes of the class have students return to the desks and go over the equipment using the **Lab Equipment Presentation** or by going to each piece of equipment and talking about it.

**Day 2**

- Students will begin part one of the **Mealworm Inquiry Lab**- Making observations and conduction research. Students tend to do a better job with the research if they do it independently. Remind the student to keep track of the sources as they will need them for the formal lab report. After 20-30 minutes of observations and measurements have students return to their seats to conduct the research. (This may carry over to the next day) Also, after each part of the lab, it may be best to require the students to obtain a teacher signature so the quality of work is up to "par" prior to moving on to each part of the lab.
- Establish your lab procedures. (stay at your station, be on task or return to your desk and work independently, clean up and ask for an inspection prior to sitting down)
- NOTE:If you do not have access to the internet you may want to prepare some research materials and have printed copies available for the students. Groups would work best with this approach just to save on copying.

**Day 3**

- Students will finish the research and complete part 2 of the Mealworm Inquiry Lab- Developing a testable question and hypothesis.

**Day 4**

- Students will continue the mealworm lab. After their hypothesis and testable question is complete, have students create procedures. Refer back to the Procedural Analysis Bell Ringer to remind students of the errors to avoid.
- You may have the students complete test trials to determine the best approach for the procedures prior to writing them.
- Be sure to check their procedures and sign off on them prior to their experimentation.
- Remind students to bring in their supplies for their lab.

**Day 5**

- Students will complete their trials. Establish a minimum number of trials for students based on the time you wish to spend on data collection.

**Day 6**

- When students have completed their data collections have them begin analyzing the data and writing a conclusion.

**Day 7/8-COMPUTER WORK-RESERVE COMPUTERS IF NEEDED**

- Using the **lab report rubric and guide** have students generate a formal typed lab report as a group or individually. (groups require less grading and students still get exposure to formal lab writing)
- Review the rubric with the students. Though the rubric is clear and the template is in place, students will need to be taught how to write a formal lab report.
- Structure time for students to work on each section of the lab report. (3 minutes to type up a hypothesis, 15 minutes to type the introduction, ect…)

**Closing the Lesson/Summary of Learning/Evaluation-**Last 3-7 minutes of class

**Day 1-** Review the Equipment/Show the students two unique pieces of equipment and have them try to determine the name and/or function.

**Day 2-**Have students share out some of their observations or something they found interesting about the mealworm.

**Day 3**-Ask students to share something they found interesting from their research. Use the name cards to call on students randomly.

**Day 4**-Ask a group to read their procedures out loud while another group tries to complete their experimental setup.

**Day 5**-Use this time to inspect lab stations to ensure student have cleaned up properly. Establish a procedure that requires you to dismiss students from the lab after you have checked their area.

**Day 6-** Have students share out their conclusions. Offer feedback to the class to improve their conclusion writing.

**Day 7/8-**Use the last 5 minutes of class to address questions and to highlight key mistakes that were seen during the class while creating the lab report. Mention that anything not complete at this point is going to be completed during their own time and due by: _____

**Day 9-Experimental Design Test**

**Differentiating the Lesson**

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| **Higher Differentiation –**Offer less scaffolding throughout the lab report process. Student will create a lab report individually<br>**Lower Differentiation –** Offer more scaffolding, partner them with a higher level learner, frequent checks for understanding and progress. |
| **Learning/Lesson Reflection** |
| **Lesson Extension**<br><br>-Have the students peer review their papers and give them an opportunity to fix them prior to submitting them for grading. Require them to use the same rubric. |