

# Teaching the Nature of Science through Gizmos: A Digital 5E Lesson Plan

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# How do we define the nature of science?

# The Nature of Science

- “how the body of public knowledge called science has been established and is added to; what our grounds are for considering it reliable knowledge; how the agreement which characterizes much of science is maintained” (Driver et al., 1996)



# Nature of Science Misconceptions

Hypotheses are only valuable if they are supported by the results of an experiment

Experiments are the only type of scientific investigation

All investigations in science are experiments

- Results of a single experiment can “prove” a hypothesis

Experiments don't need to be repeated

Investigations that don't reach a firm conclusion are useless

# Nature of Science on the FSA

**Table 2: Statewide Science Assessment Content Categories**

Grade	Nature of Science	Earth and Space Science	Physical Science	Life Science
5	17%	29%	29%	25%
8	19%	27%	27%	27%

- Statewide, only **47% of 5<sup>th</sup> graders** and **48% of 8<sup>th</sup> graders** passed their science statewide assessment in 2021

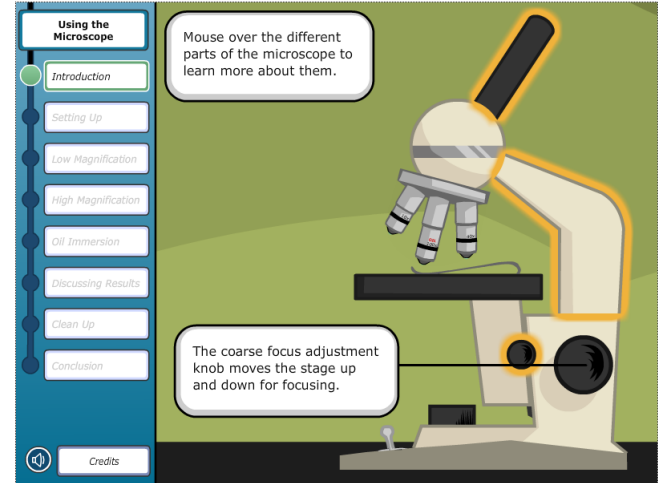
# Digital Learning

- More and more digital learning taking place in our classrooms
- Difficult to engage students in conducting experiments



# Virtual Labs

- Ease of use
- Grade level and content
- Teacher resources



# Gizmos

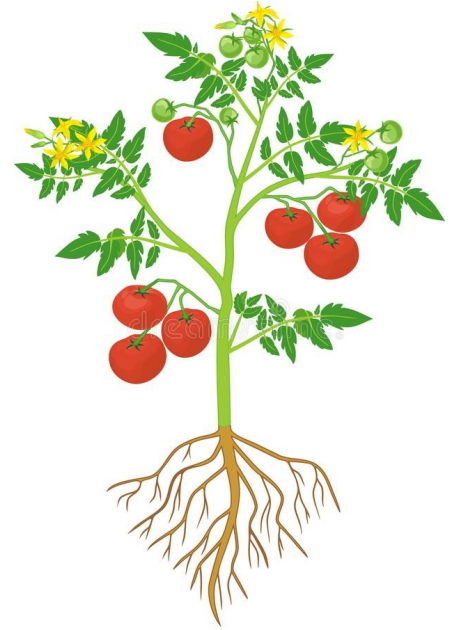
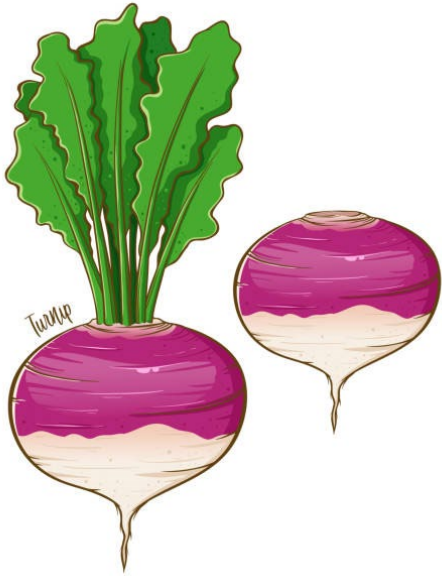
- The Gizmos “Growing Plants” is a relatively simple simulation where students can manipulate four different variables to observe their effect on plant growth
- Growing Plants provides all students with everything they need to plan and carry out a controlled experiment





# 5E Lesson

# Plant Battle



# Creating an Account on Gizmos

Step 1: Create account on Gizmos using the teacher class code “RKNLR2” and the instructions on the right

Step 2: Make a copy of the Student Handout at <https://bit.ly/gizmoplant>

## Enrolling at ExploreLearning.com



Follow these simple steps to enroll in your teacher's class:

**Step 1:** Go to <https://www.explorelearning.com>

**Step 2:** Click on the “Enroll in a Class” button in the upper right hand corner of the web page.

**Step 3:** Type in your teacher's class code: RKNLR2  
Click “Continue” and follow the directions on the site to complete your enrollment.

**Step 4:** Write down your username and password and put this sheet in your class notebook.

username: \_\_\_\_\_

password: \_\_\_\_\_

**Congratulations!** Now that you're enrolled, you can login anytime using just your username and password (no class code required).

# Design a controlled experiment to test how a single factor affects plant growth.

Options:

- Students work alone
- Students work in partners
- Students work in groups with assigned roles



# Explain

- Students share the results of their experiment
- Which condition of their independent variable was the best for your plant type?

Optimal Conditions for Plant Growth

	Turnip	Tomato	Bean
Light (High, medium, low, or none)			
Soil or fertilizer or none			
Water (mL)			

# Elaborate

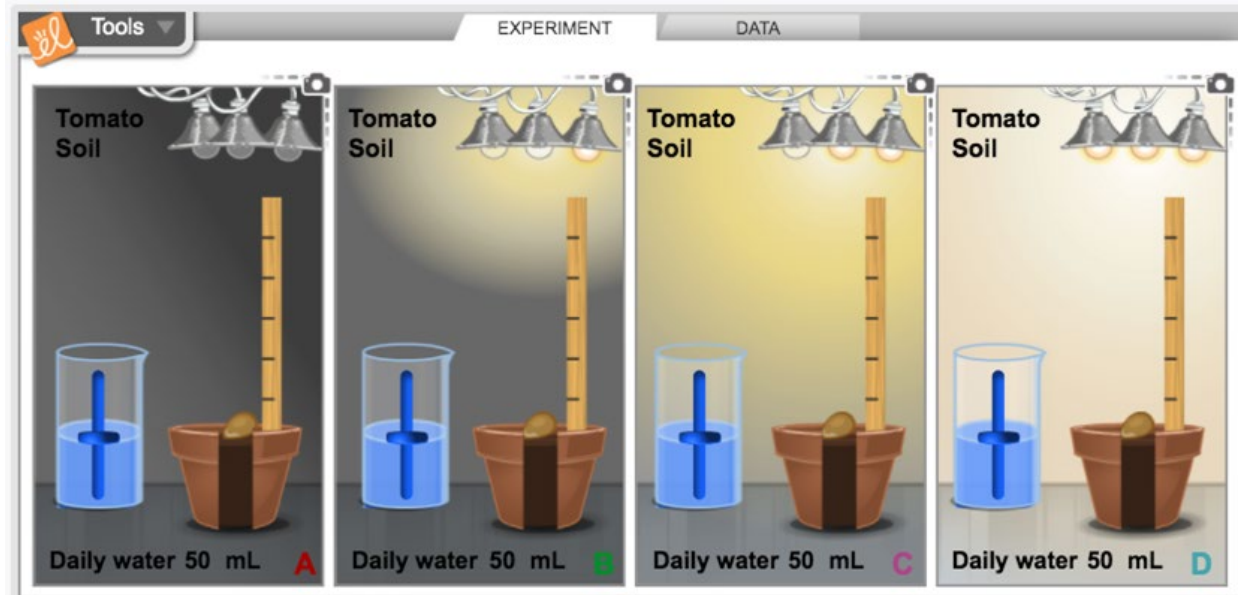
Students can apply their knowledge of experimental design in many different situations

- Mythbusters clips
- Spongebob examples
- Designing experiments to help solve relevant problems in their lives (as a lead in to Science Fair)

# Exit Ticket

You stumbled into a lab where you observe this experimental setup.

1. Write an experimental question this person might have been trying to answer
2. Write a possible hypothesis they were testing
3. identify their independent variable, dependent variable, controlled variables
4. Which plant (A, B, C, or D) is their control group?





# Example Student Work - Level 1

Now you will design and conduct your own controlled experiment!

2. Experimental Question: (For example: What is the effect of **Independent Variable** on **Dependent Variable**?)

When adding too much water to the seed, the seed will grow and not just water will effect the seed it's also the light

- 3 Independent Variable:

The amount of light, the amount of water

4. Dependent Variable:

The type of seed

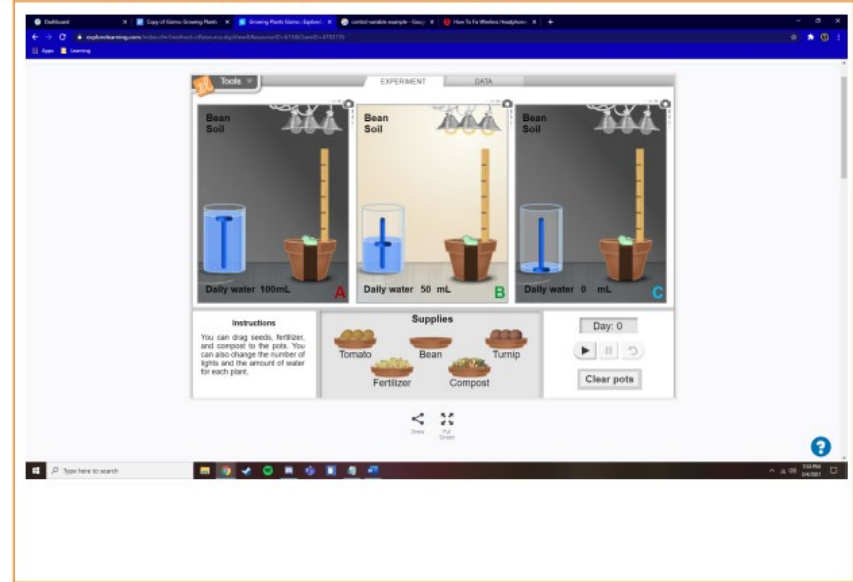
5. Controlled Variables (constants) \*Include at least 3:

The flower pot and the ruler

6. Which pot is your control group? (This is the group that does not receive the experimental treatment, or the group under "normal" conditions)

Plant B

8. Take a screenshot of your experimental setup and insert it below.





# Example Student Work - Level 2

2. Experimental Question: (For example: What is the effect of Independent Variable on Dependent Variable?)

How does the amount of water affect the plant growth?

3. Independent Variable:

water

4. Dependent Variable:

Plant growth

5. Controlled Variables (constants) \*Include at least 3:

Water, light, soil

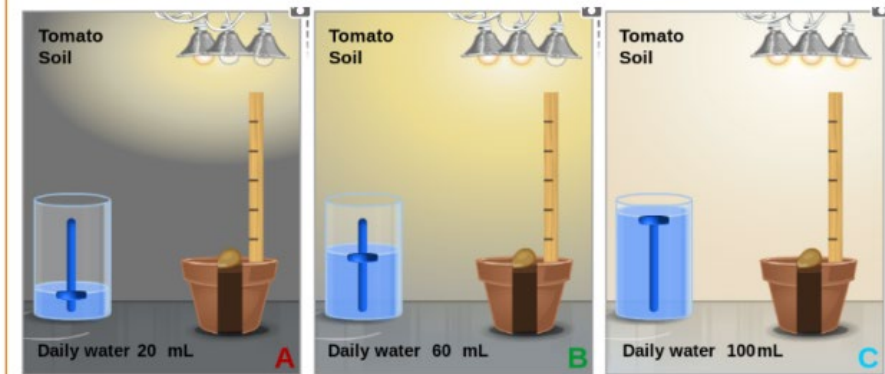
6. Which pot is your control group? (This is the group that does not receive the experimental treatment, or the group under "normal" conditions)

Pot a

7. Hypothesis:

The plant will grow slower if it has less water and light

8. Take a screenshot of your experimental setup and insert it below.



# Example Student Work - Level 3

Now you will design and conduct your own controlled experiment!

2. Experimental Question: (For example: What is the effect of **Independent Variable** on **Dependent Variable**?)

What is the effect of different types of nutrients on bean growth (in height)?

3. Independent Variable:

Types of nutrients

4. Dependent Variable:

Bean growth (in height)

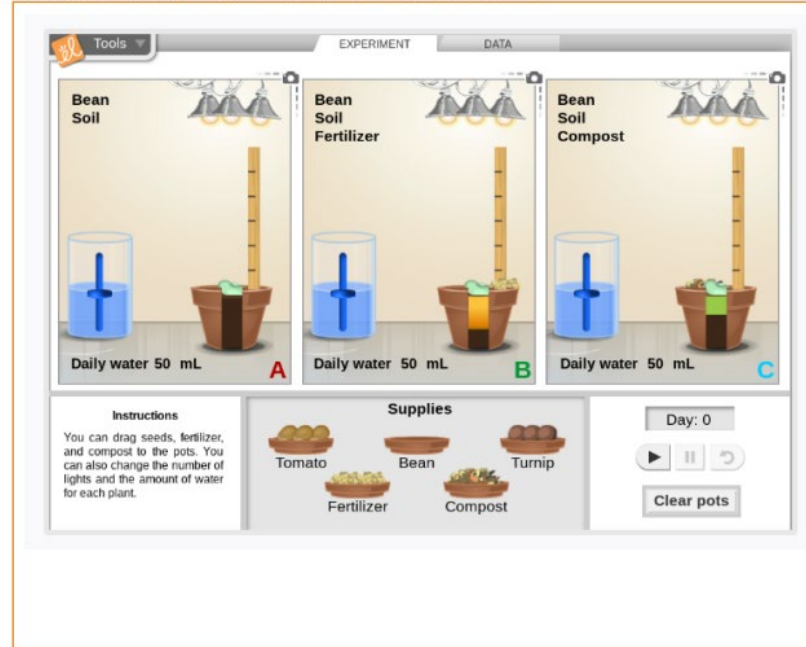
5. Controlled Variables (constants) \*Include at least 3:

1. Daily water (50 mL)
2. Amount of lights (3)
3. Seed type (Beans)
4. Amount of soil

6. Which pot is your control group? (This is the group that does not receive the experimental treatment, or the group under "normal" conditions)

The first pot is my control group. It follows all of the controlled conditions, but does not have fertilizer or compost.

8. Take a screenshot of your experimental setup and insert it below.



# 5E Lesson Plans

- Grades 3-5: <https://bit.ly/gizmo35>
  - Grades 6-8: <https://bit.ly/gizmo68>
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- Alternative, free simulation where students can conduct a controlled experiment similarly: <http://amrita.olabs.edu.in/?sub=79&brch=16&sim=126&cnt=4>

# Questions?

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