How do Plants Change as They Grow?

Learning Goals:

Science Focus

- Understand that growth in plants represents an ordered sequence of developmental events that vary between individuals within limits that are defined as typical.
- Generate knowledge about plant growth by measuring plant characteristics as they change in size and complexity.
- Explain plant variation in plant characteristics using environmental factors, time, and genetics.
- Characterize a population of organisms using the shape of the distribution of data and descriptive statistics.

Data Focus

- Observe and measure characteristics of growth and development to discuss variation among individuals in a population of plants.
- Generate samples of data about plants and discuss implications of different sample sizes.
- Create and read data displays using scale, order, grouping, and frequency.
- Compare different displays of the same data to discuss what the displays show and hide.
- Identify measures of center and how they can help characterize a population of organisms.
- Make sense of variation and describe sources of variation, both natural variation and measurement error.
- Analyze data with Tinkerplots or CODAP.

Teacher Guide

How do Plants Change as They Grow?

Investigation Overview

Variation, differences based on both genetics and environmental factors, is a fundamental attribute of life. Individual organisms vary from one another, and organisms vary over time. This investigation allows students to observe, describe, and measure variation using a model organism, Wisconsin Fast Plants (WFPs). Focusing on the guiding question, **"how do plants change as they grow?"**, students will plant, observe, and measure WFPs. This activity provides opportunities for students to make observations about individual differences in WFPs and how they change as they grow. They then make decisions about how to measure those observations to generate quantitative data and create data displays to make claims about how plants grow. As they make claims, students will have opportunities to explain how different sources contribute to the variation in the data. These explanations help students consider the different inferences you might make about the variation. For example, if we think all the variation is from measurement error then we might interpret it as mistakes or noise. If we think the variation is from errors in a production process, then we might interpret it as things to improve in the process. In this investigation, though, much of the variation comes from differences in environmental and genetic factors, which provides opportunities to use the variation to explore the factors that impact plant growth.

This investigation equips students to understand that quantitative data emerge from decisions they make as they measure, organize, and analyze their data, and how, ultimately, their choices provide evidence to support their claims about plant growth. This activity also provides opportunities to contrast ways of thinking about variation that students may have been exposed to in their mathematics classes.

What is a Model?
The unit begins with a discussion about models. Teachers facilitate the conversation to help students see that in any model the following are typically true: 1) A model represents something else in a way that helps study or understand the real thing, 2) A model chooses some aspects of the target phenomenon to highlight, 3) A model ignores some aspects of the target phenomenon, 4) A model corresponds to the target phenomenon in some meaningful way.

Planting Plants
Students prepare indoor growing stations and plant WFPs. Students discuss the conditions under which the plants will be growing, and the ways the WFP environment is similar and different from plants growing in the wild. As students plant, they predict what their data will look like as plants grow under identical conditions.

How do Plants Change as They Grow?

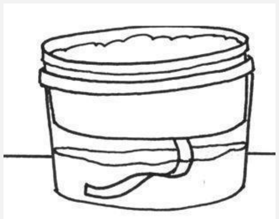
Creating Data
There are many different ways to measure things. The units and tools used, the method we use to measure, and the attributes we measure, all need to be discussed and agreed on. Students will discuss how plant characteristics can be quantified and develop measures for their Wisconsin Fast Plants to build a model of how plants grow. Each day students make measurements and observations about changes in the WFPs and record these in their journals.

Data Conversations
Students create data displays to communicate to readers important aspects of plant growth and share them with the whole class. They have opportunities to ask questions of each other, compare their different data displays, and disagree about their findings. After this conversation, students revise their data displays and claims and share them publicly.

Materials

Deli container (8 oz.)
Deli container (16 oz.)
Wicking medium
Black Gold Potting mix
Wisconsin Fast Plant Seeds
Student Data Charts
Sticky Notes
Colored plastic plant tags
Small artificial plant
Water
Fertilizer pellets
Plant grow light
Rulers
Measuring scoop
Markers
Tinkerplots or CODAP

To assemble the growing system:
This video features a similar assembly.
https://www.youtube.com/watch?v=WSOpYZIRwtQ



1. Soak the wick in water.
2. Insert the wick through the hole in the smaller container so that all but 3-4 cm hangs down into the lower reservoir.
3. Fill the **smaller** container with about 1/4 cup potting mix. Do not pack the potting mix down.
4. Spread around 8-10 pellets of fertilizer on top of the soil.
5. Add 1/2–3/4 cup of soil on top of the fertilizer pellets.
6. Sprinkle water over the top of the soil until you can see the water dripping from the wick underneath the cup.

7. Place 3-4 seeds on top of the wet soil. Distribute them evenly. Do not press them down.
8. Cover the seeds with 1/4 cup of soil. Do not pack it down.
9. Pour 1 cup of water into the **larger** container.
10. Set the smaller container into the larger container with the ends of the wick floating in the water.
11. Lightly sprinkle water over the top of the soil covering your seeds. Remember to add water when needed.

Place your growing system under the plant light:

12. Prop the growing systems up so the top of the pots is 10 cm below the light.
13. Turn on the light, and leave it on 24 hours a day. Plant germination should occur within the first 72 hours (If seedlings do not appear within 4 days after planting, start over.)
14. As soon as the sprouts are visible, place a different colored plant tag near each seedling. These will be used to identify the plants.

Student groups record measurements and observations of the plants every 48 hours on the student data sheet.

Once flowers have appeared (days 13-17 after germination), plants should be pollinated by hand using a cotton swab or bee stick.

Student Thinking & Assessment

Plant growth represents an increase in size, number and complexity of plant cells and organs. Both environmental and genetic factors play a role in growth. Students have observed variation in plants in the wild space activity, or in nature. They may have attributed this variability to temperature, light, soil, water, and human activity. These factors are controlled in the growing systems. In growing WFP, students will encounter variability due to factors that may not have been readily observed in the wild space activity, or in nature. This may include measurement error, natural variability within a species, and differences based on planting conditions.

Variation between plants for a particular phenotype (visible trait) is determined by the genotype (genetic makeup) of the individual plants **and** their environment. To describe the variation, a trait must be observed. The observed traits might then be quantified and measured. Some traits of the WFP where students may observe variation include plant height, leaf size and number, and number of flowers. These traits will vary among plants that were planted at the same time. For example, when students record the height of plants in their group's growing system they will observe that not all plants are the same size. Students can use their data to describe variation and consider sources of variation.

Students can discuss how confident they are that their individual measurements describe a “typical” plant. Scientists rarely make claims based on a single sample. When students combine measurements from across different groups they can explore the following questions by analyzing data shape and distribution:

- What does a “typical” plant look like?
- Do students consider their plants to be “typical”? Why or why not?
- How much did the plants tend to grow each week?
- Are there any "unusual" plants that appear to be outliers?
- Are the plant heights more alike when they are younger or when they are older?
- What might have caused the differences we observed in our plants?

There are many other ways that students may have suggested to measure growth and development in the development of the measurement protocol. These may also be used to make inferences.

How do Plants Change as They Grow?

Connection to Mathematics

This investigation is designed to be coordinated with mathematics instruction on variability, visual data displays (often called graphs), and statistics. The mathematics instruction on data displays can be found in Unit 1 (Inventing Displays) of Rich Lehrer's Data Modeling curriculum and instruction about statistics can be found in Unit 2 (Measures of Center) and Unit 3 (Measures of Variation). These units support students to learn about variation and how decisions about visual representations structure variation into various shapes that inform readers about characteristics of the data. Statistics are then introduced as measures of data characteristics that emerge from the visual data representations. More information can be found in the Data Modeling curriculum materials about the learning goals in these units. We suggest one of the following strategies to support students:

Coordinated
Coordinated approaches consider ways for students' work in math and science classes to inform each other. For example, students may bring repeated measures of the same plant into their math class to begin their Data Modeling unit, and then bring records of their mathematical work back to their science class to inform their investigations.

Sequenced
Sequenced approaches make scope and sequence decisions to ensure that the mathematics classes complete Data Modeling Units *before* you conduct this investigation.

Implementation

What is a Model?

(Whole Group)

1. Ask students to think of an example of a model of something. Show a few examples of models, such as model cars, maps, clothing models, or a model of a scientific explanation of a phenomenon...like the water cycle. For each example, ask questions to help students consider what each means to be a model:
    a. What does it mean for this to be a model?
    b. How do people use it?
    c. If this is a model, how does it relate to the "real" thing?

(Small Group)

1. Ask students to discuss with a partner the following questions to get them thinking about what a model does:
    a. What do you notice that's similar about all the models we've talked about today?
    b. What differences did you notice?
    c. When you compare the model to the thing the model represents, what are some things that are important to make it a good model?

(Whole Group)

2. Make an anchor chart on the board or on chart paper to record student ideas: Be sure to include these ideas:
    a. A good model represents something in a way that helps you study it or understand it better
    b. A good model chooses to represent or emphasize certain aspects of the thing you are modeling
    c. A good model also ignores some aspects of it, in order to simplify it
    d. Parts of the model represent parts of the thing you are modeling in some meaningful way

Planting Plants

(Whole Group)

1. If your students have been conducting nature observations, ask them to share some of the things they have noticed.
2. Ask your students to share questions they have about the plants they have been observing.
3. Connect their questions to the conversations that you have been having about

models to describe Wisconsin Fast Plants, and how they often serve as models to study plants for many scientists. Tell students they will be growing WFPs to study how plants grow.

4. Ask students about the factors that they think influence plant growth.
5. Emphasize that the first thing they are going to explore is how plants grow if their **conditions are all the same**.

(Small Groups)

6. Provide instructions for students to build the growing setup and to plant their WFPs.
7. Walk around and observe students working in their groups to plant the plants. Listen for their questions about the growing conditions.
8. Have students place their plants under the grow lights (4 per light)

(Individual Work)

9. After planting, ask students to write about how growing WFPs is a model of plants growing in nature. Ask them to list things that are similar and different.
10. Ask students to record what they think their data will look like from the plants all growing in identical conditions.

(Whole Group)

11. Ask students to share their reflections. Make connections to the list of "good model" characteristics. Consider questions like these to support the conversation:
    a. How are the WFPs in our class similar to the plants growing out in the yard?
    b. How are they different?
    c. What do you think we will be able to learn about plant growth from our investigation?
    d. What will we not be able to learn about from this investigation?
12. Ask students to share some predictions they recorded (#10) about what their

data will look like.

Creating Data
During the two or three days before the seeds germinate, students should develop a measurement protocol to guide uniform measurement practices.

(**Whole Group**)

1. Use a small artificial plant to guide this discussion. Allow each student to measure the plant independently without discussing their measurement strategy with other students. Record measurement on a sticky note.

   Note: *Some students may measure height, width, or some other quantifiable aspect of the plant. This allows students to discuss and come to a consensus about what best describes changes during plant growth.*

2. After all students have measured, randomly display the sticky notes on the board. Ask the students: What are two things you notice about our data and what are two things you wonder?
3. Students will probably notice that they didn't all get the same measurement. Discuss possible reasons.

   Note*: Students might talk about using different units (centimeters or inches), measurement strategies that would produce gap or overlap (flipping the ruler or sliding the ruler), calculation errors, lack of precision, choosing different attributes (height, width, number of leaves/stems), or choosing different starting or ending points (table top to plant top or top of pot to plant top).*

4. Ask student groups to describe their measurement procedure. Clarify the need for a uniform measurement practice so that we can commonly interpret our data.
5. Use student ideas to create the ***protocol*** that will be used to take measurements of the plants. Record this protocol on chart paper or on the board.
   Ask the following:
   - What plant characteristics can be quantified? How will plant characteristics change as the plants grow? (get taller, more leaves, develop buds, flowers, seed pods)
   - How can each of the changes be measured?
   - What units would be best to measure the growth of our plants?
   - If we need to compare our plants, what are some important things to consider about measurement?
   - How often should we measure?

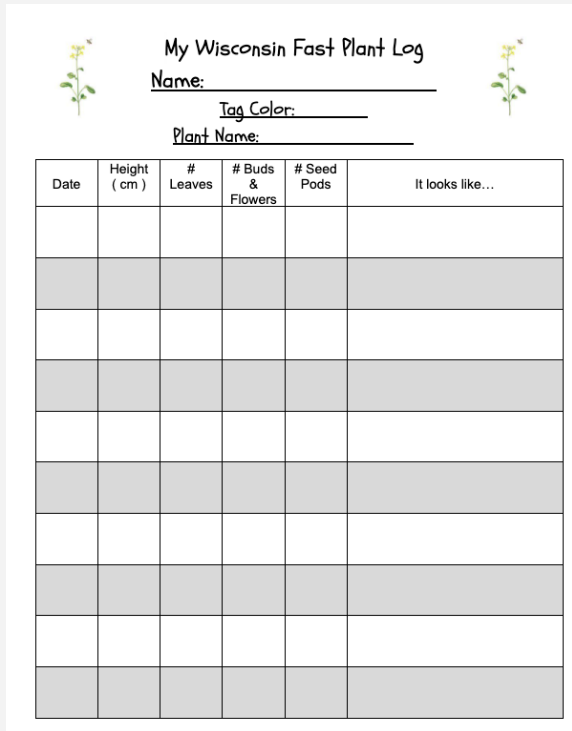
(Individual Work)

6. In their journals or google classroom, have students respond to this prompt:

   Since we all planted our seeds on the same day and are measuring them in the same ways, do you predict that all of our measurement data will look the same? Why or why not?

   Note: *Revisit this during the week 2 data conversations.*

Students should be able to see evidence of germination within 48-72 hours. Allow students a few minutes to collect data and observations about changes in the plants every 2-3 days (as decided by the class protocol).


My Wisconsin Fast Plant Log

Name:

Tag Color:

Plant Name:

Date	Height (cm)	# Leaves	# Buds & Flowers	# Seed Pods	It looks like…

7. Make sure students have access to the [plant growth data charts.](plant growth data charts) Have students fill in the colors they selected to identify their plants. Describe/allow a student to demonstrate plant height measurements that students will take and record each day using the class' developed protocol. Encourage students to include their own indicators of plant growth and record these measurements in the observations.

Data Conversations

The life cycle of WFP is about 21 days. Regular conversations about the observed changes and plant measurements support the development of students' ideas about the nature of various factors underlying biological variation. Each of the conversations can include an additional factor that students described as a possible measure of plant growth and the plant height data.

These may include

- Number of true leaves on the plant,
- The number of days it took the first flowers to appear,
- The number of pods produced,
- The length of seed pods,
- The size of leaves.

These conversations also create opportunities to reason about the variation in data, to begin to explain where the variation comes from, and to make claims about typical plants and unusual plants. Students are likely to draw on these ideas to do this.

- Measurement error,
- Environmental factors,
- Genetics,
- Time and plant life cycle.

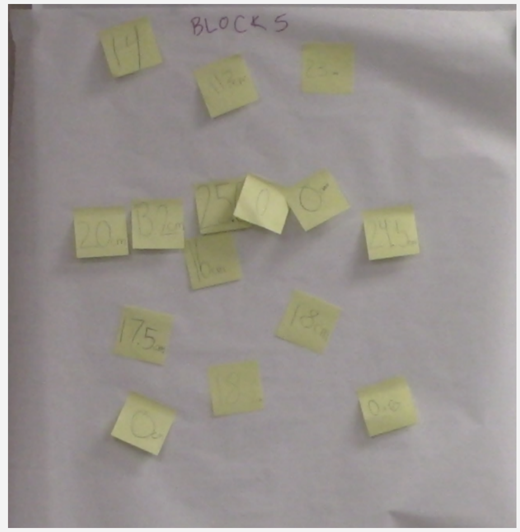
(End of week 1: 1 class period, emphasis on qualitative observations) How do plants change as they grow?

(**Whole group**)

1. Teachers facilitate a discussion of the following ideas. Some of these questions could also be turn and talk prompts or individual journal prompts:
    a. What differences do you notice as the plants are growing?
    b. Are all plants growing and changing in the same way?
    c. What do you predict is the next step in your plant's development? Why do you think the plant develops in this way? (For example, why do leaves develop before flowers?)
    d. Connection to Wild Space/Environmental Variables lesson(s) if applicable: Does the WFP look like any plants you observed in the wild space activity, or in nature? How are they similar? Different? Revisit the idea of a model. What makes this a good model? What would make it a better model?
2. What can we tell from looking at just our plant? Is it enough to just look at one plant, or do we need more data to make a claim about how plants change as they grow?

(End of week 2: 3 class periods, emphasis on explaining variation and organizing data) Why didn't we all get the same measurements? Where does all this variation come from?

> **Note**: *To prepare for these conversations, teachers will need to collect and record the most recent measurements (height, number of leaves, number of buds and flowers etc.) Students will use this data to create a data display and the data should be in an unordered list for each attribute. Provide each student team a copy of the data.*



1. Teacher displays all students' (all students in one block) most recent height measurement on the board in an unorganized way. Use sticky notes or magnetic cards or digitally using Jam Board.

(**Whole group**)

2. Ask students: Why didn't we all get the same measurements? What causes this variation? Make a list on the board looking for:
    - Measurement error –
      Discuss the class developed measurement protocol
      Why is there still measurement error?
    - Natural variation –
      What were sources of variation we predicted from the wild space activity? What ways were variables controlled for our WFP?
      What other factors could cause the variability (environmental or genetic) we still see?

3. Do you think these causes all have the same impact on the variability? If not, which factors have more impact? What makes you think this? How much of this variability do you think is from measurement errors alone?

   Note: *Look for these ideas about variation from students: measurement precision (less impact), genetics of the seeds (was the seed harvested from a tall plant or a short plant, genetic programming of where the plant puts its energy such as height or leaves or flowers, location of the plant in the classroom (less impact) , etc. We will need these ideas later to develop a class data display that will help us better understand where all of the variation is coming from.*

4. What could we do with all of this plant height data from this class to be able to see what it is telling us? What have you learned about data displays in your math class that you think might help you?

   Note: *Listen for them to highlight ideas about order, scale, count, grouping and that displays often hide something in order to show something. (e.g. Frequency of* *individual data points might be hidden when using bins).*

5. The teacher or students come to the board and begin to incorporate the class ideas to organize the data into a display that shows these ideas.
    - Ask questions about what the data display shows. Look for ideas about center (mean, median, mode) and spread (range, outliers, max and min).
    - Ask students to think about the other plants from other class periods. What were we able to see about plant growth from visualizing our whole class's data? Do you think other classes' data looks the same as ours, or different? Why? In what ways?

(Small Group: Applying ideas from previous whole group discussion) Students will need the data handout that includes the unordered list of all attributes measured, chart paper, and markers.

6. Take a look at your data handout. What does our other data tell us? What do you notice about the data? What do you wonder?
7. Pick an attribute we have measured (other than height) and create a data display to help someone understand how Wisconsin Fast Plants change as they grow.
8. Students create their data displays on chart paper. As they work, walk around with an eye for the kinds of things in the data they are finding important, and the strategies they are using to create data displays.

(Whole Class)

9. Hang or project the data displays in a visible part of the class, and provide students an opportunity to look at each of them in a Gallery Walk.

10. Facilitate a conversation that compares the different approaches. Pick 2-3 different displays to compare what they show and hide. Some possibilities: A display that shows order only, one that shows frequency only, and another one that makes the center clump very visual. Have the creators of the displays share what they were trying to show with their data display and why they designed it the way they did.
    Discuss the following:
    a. What does each representation show about the data?
    b. What does each hide about the data?

c. What does each tell us about our plants as they are growing?

Note*: It can be difficult to allow students to share their data displays without quickly evaluating them in terms of similarity to conventional displays (i.e. histogram). However, work to let the students evaluate each display based on what it tells them about their questions. The point is for them to use the displays to learn about WPF growth, not necessarily to follow all the rules to make a conventional display.*

11. Ask students if there are any changes they would make to their display after the conversation. Look for specific responses such as, put the data in order from least to greatest, stack repeated values, put data into smaller bins, etc.
12. Remind students that the other classes carried out the same investigation. Ask them what they think the other classes' data looks like? How could that help us?

At this time your plants should be hand-pollinated so that they produce seed pods.

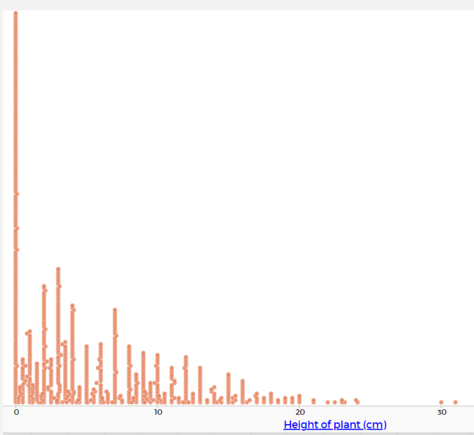
(End of Week 3: 2 class periods)
What does a typical adult WFP look like, at the end of the growing cycle ? Analyze All Classes' Combined Data by utilizing technology (CODAP or TinkerPlots).

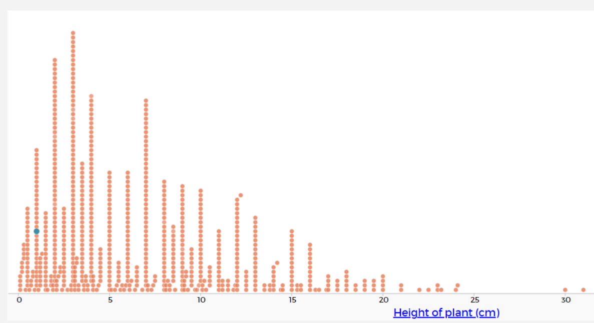
1. For your last data collection, students will enter their data electronically so that it can be displayed in a spreadsheet. Use this Google form
2. Follow all directions carefully; for example, all responses should be numerical and students should enter fractions as a decimal. In the Google form, go to Responses and choose Google sheets. This is a picture of a sample spreadsheet.

How do Plants Change as They Grow?

	A	B	C	D	E	F	G	H	I	J	K
1	Timestamp	Person Nam	Science Block	Plant Name	Date (mo	You planted y	Height (cm)	Number of leaves	Number of buds & flowe	Number of Seed I	Any other observa
2	9/25/2023 13:55:	t s	1st Block	One	2/24	21	13.8	6	6	0	beautiful
3	9/25/2023 13:56:	e s	1st Block	two	2/24	21	15	7	7	6	tall
4	9/25/2023 13:57:	t p	1st Block	three	2/24	21	10.5	7	4	1	one seed pod
5	9/25/2023 13:58:	b d	1st Block	four	2/24	21	12.5	7	5	9	9 seed pods
6	9/25/2023 13:58:	a w	1st Block	five	2/24	21	15	8	10	2	not really
7	9/25/2023 13:59:	p y	1st Block	six	2/24	21	18	8	7	5	pretty
8	9/25/2023 14:00:	l m	1st Block	seven	2/24	21	16.5	7	4	0	no
9	9/25/2023 14:01:	b v	1st Block	eight	2/24	21	15.3	5	3	4	tallest day
10	9/25/2023 14:02:	c f	1st Block	nine	2/24	21	17	10	7	6	looks the tallest
11	9/25/2023 14:02:	s d	1st Block	ten	2/24	21	11	8	11	2	none
12	9/25/2023 14:03:	j k	1st Block	eleven	2/24	21	13	4	8	8	lots of seeds
13	9/25/2023 14:04:	y l	1st Block	twelve	2/24	21	11.8	7	11	5	flowers
14	9/25/2023 14:05:	b n	1st Block	thirteen	2/24	21	13.5	4	6	7	grew
15											
16											

3. Before students analyze the data, the zero height measurements (representing plants that didn't sprout or died during the experiment) should be removed. The two graphs below show data collected across multiple blocks and over the course of the experiment. The graph on the left includes the zero measurements and students may conclude that a typical plant has a height of zero based on the mode. Therefore, you will need to delete or hide these cases.





4. Tell the students to work in their groups to create data displays that would help a reader answer the question: *What does a typical adult WFP look like?* Students can use height data, or other data, or a combination.

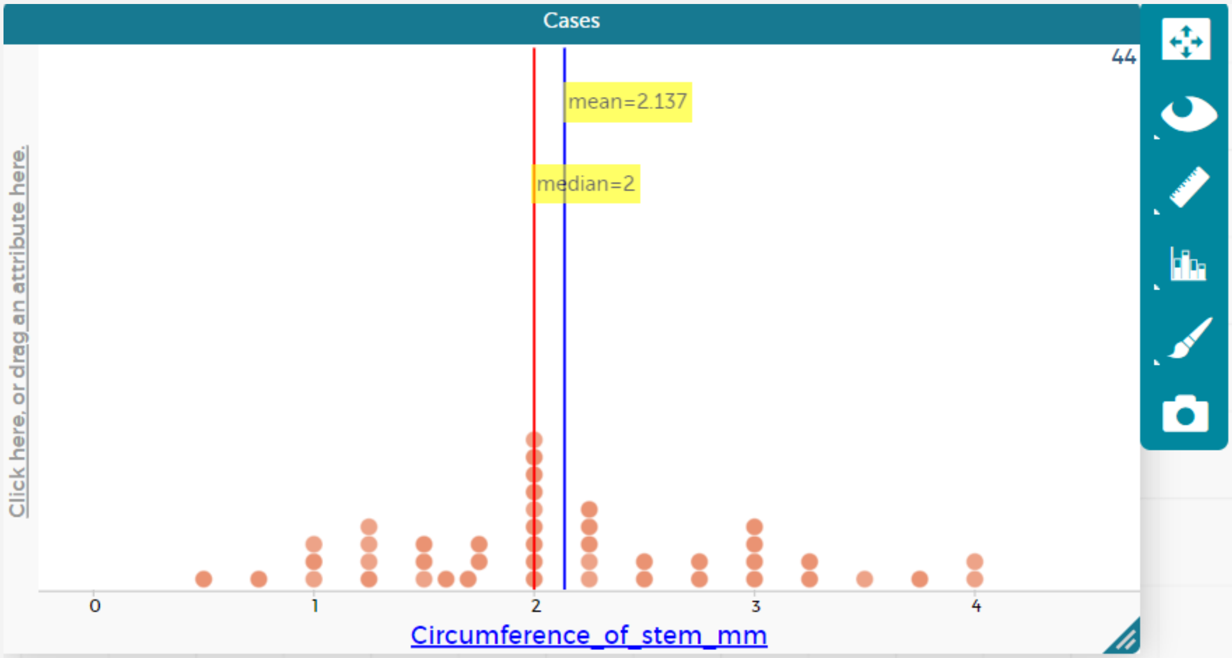
5. Students create their data displays using Tinkerplots or CODAP.

Teacher Note: *It is useful to create a data display for each attribute yourself so that you can anticipate student claims, develop guiding questions, and troubleshoot.*

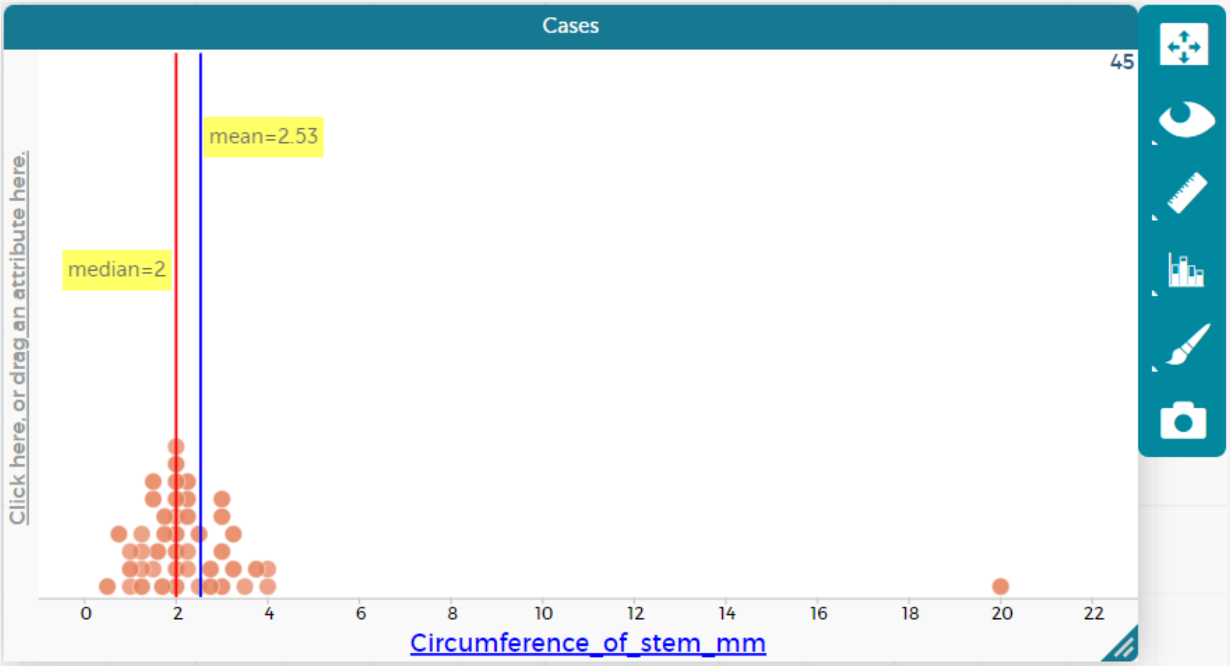
6. Have students make a claim about their data using the text box feature. Some recommended sentence frames are:
    - A typical adult WFP is ___ cm tall. I know this because the (choice of measure of center such as mean, median, mode) is ___ cm. I chose this measure of center because ________________________.
    - A typical adult WFP has ___ leaves. I know this because the average number of leaves is ___. This average is the ____ (mean or median or mode). It is a good choice because it tells ____________________ about the data.
    - Similar sentence stems can be used for buds and flowers or a combination of attributes.

Note: *Students have learned measures of center, also known as averages in their math classes. Have an explicit conversation with students prior to them developing their claim. Include ideas about mean, median, and mode and what those Measure of Centers (mocs) highlight as well as when to choose a certain moc to best summarize the data set. The following examples can be used to build teacher background knowledge and facilitate this discussion. These examples will help students to better justify the claim they make with their own data.*

Examples of data displays generated using CODAP of an attribute that students didn't measure, stem circumference.



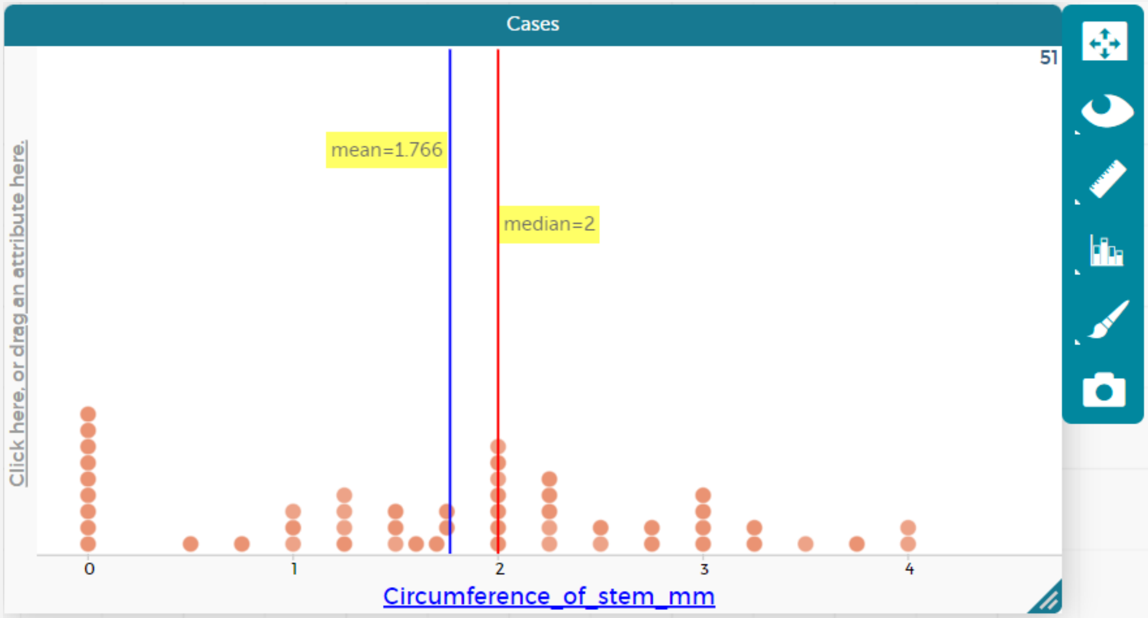
Measures of center are similar. Mean is 2.137 cm and the median and mode are both 2 cm. Maybe notice the spread and shape of the data and discuss what the measures of center represent. Which measure of center best represents the average of this data set? Note: since there are no outliers and since the 3 values are all very similar, there is not a Measure of Center (moc) that is a better choice over another one. How does the shape of the data relate to the measures of center? How do you feel about the mean being a value that is not an actual data point? Remember, the mean is a mathematical calculation, so oftentimes it will be a number in between some data points.



Discuss why the mean is higher. The mean is sensitive to outliers. Here a student entered 20 instead of 2.0 for their measurement. What would happen if 2 students entered the data as 20?

In this case, which measure of center best summarizes the data? Notice, the median and the mode were unaffected by the outlier. Therefore, the median or the mode best describes that average circumference of the stem.

Also, notice the range. Note: In this data display the presence of the outlier causes the visual display to shift. However, the shape is the same as the previous data display, except for the tail connecting the outlier.



What affected the lowering of the mean in this data set? Students entered zeroes for their dead plants. Are these zeroes meaningful? When could zeroes be meaningful? (Zero seed pods would indicate flowers were not effectively pollinated, zero flowers might indicate the plant is not fully grown.) Which measure of center best describes a fully grown plant in this scenario? Would both median and mode work in this case? Notice the mode is zero, so only the median best summarizes the data.

7. Have students save their final data display as an image.

(Small Group)

8. Students will share their Claim, Evidence, and Reasoning. Design a rotation so that all students share and discuss their conclusions. Students could use a notetaker that includes each group's claim and reasoning.

9. Students as listeners should be thinking about how the strategies are the same and how they are different, do the strategies account for variation in the data? And how? Is there anything the group could add to their reasoning that would make it more understandable?
   Some questions they might have for others while listening could be *why did you use flowers?* Or *why do you think mode is a better choice than median?* Or

would your reasoning work if we combined all the data from all the science teachers (larger data set)?

10. As students are sharing as groups, monitor and look for 2 -3 examples to be shared as a whole class. Possible choices: a group that uses leaves only versus a group whose claim involves 2 or 3 attributes, a variety of moc's used as evidence in their CER, a strong justification for use of a particular moc, etc.

(Whole Group)

11. Have a whole group discussion using the examples you chose.

At the conclusion of this investigation, the seeds can be harvested and the plants can be disposed of. Keep reusable materials for future plantings.

Extension Options

To apply these principles and provide purpose for these types of investigations, various extensions could be assigned. It is important to include STEM careers in science lessons.

Designing a Plant Tag

As they develop new varieties of plants, horticulturalists often need to describe a "typical" fully grown plant so that consumers will know what to expect from the plants they buy.

Design a plant tag using your findings that describes a fully grown Wisconsin Fast Plant.

News Feed Announcement

Botanists often discover new types of plants. They need to describe a "typical" fully grown plant of these new species so that other scientists can learn about them.

Pretend that Wisconsin Fast Plants are a completely new species and create a "News Release" that describes their attributes. Use claim, evidence, and reasoning in your announcement to the world about the discovery of a new plant species.

Design a Wanted Poster

Ecologists and environmental scientists often find invasive plants that are not native to an environment, and once introduced, they cause harm to the environment and the ecosystem. These scientists need to describe a "typical" invasive plant so that these plants can be removed from the environment.

Research invasive plant species in your region. Design a Wanted Poster to find and identify invasive species in an ecosystem. Name the plant, describe it (including typical height measurements and other quantifiable attributes), and list the harm it causes.