Lesson 13 – Statistics of our seeds*

*Allergy: Lemon, apple allergies should be assessed before participation in this lesson.

Overview

This lesson is about the role of statistics in science. Statistics are numbers used to describe or summarize data. Specifically, this lesson will focus on the mean and the median. These are statistics that describe group data with a single number. They tell us something about what is typical in a group of numbers. Scientists use statistics to summarize and describe information and relationships in order to facilitate science communication. UQUEST scientists will learn about two single numbers that can describe data: **mean** and **median**. For example, we can use the mean or median height of a class to describe the height of the class.

UQUEST scientists will use numbered cards to learn how to find the mean and median. They will then practice calculating mean and median using extracted lemon and apple seeds, while also learning about the nutritional benefits of seeds... all while eating popcorn, another type of seed! UQUEST scientists will be able to calculate mean and median to summarize their data.

Science Objectives

UQUEST scientists will:

- understand that statistics are ways to summarize and describe information
- learn how to calculate mean and median to describe data

Health Messages:

- Not only do seeds produce healthy fruits and vegetables, but some seeds (e.g., corn, peas, beans, nuts, sunflower seeds, pumpkin seeds) also have their own source of nutrients, like fiber, protein, vitamins, and minerals
    - Fiber helps to move food through the body, protein helps build muscle, vitamins and minerals build your immune system to help fight germs

Reinforcement of previous messages:

- Observation (Lesson 1) - need to observe to collect data
- Variability (Lesson 2) – using statistics to compare how data vary.
- Observational studies (Lesson 8) - we are not manipulating the color of the lemon, orange, and tangerine, just observing the number of seeds in each fruit
- Data collection (Lesson 12) - using collected data to calculate mean and median.

Vocabulary:

- **Statistics**: ways to summarize and describe information.

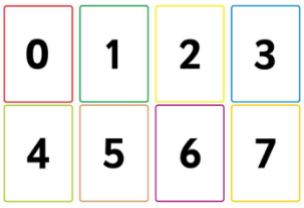
- **Mean**: a number that represents the average data.
- **Median**: the middle number of the data.

Materials:

- UQUEST kit
- Lemon and apples
- Popcorn
- Tweezers (kid-friendly) – 1 for each UQUEST scientist
- 1 sets of numbered cards (5 cards) per group
- Flashcards (1 per scientist) (colorful cards to be more fun, if possible)
- 1 calculator per group
- Paper plates - 1 for each UQUEST scientist
- Napkins
- 1 large dry erase board for graphing– for whole class (don't need magnets)
- 4-5 Dry erase boards and markers for team calculations – one for each team

Preparation:

At UM:

- Divide fruit slices into three separate containers: lemon, orange, and tangerine
- Prepare a stack of 5 random numbered cards for each team.
  - 

At OYC:

- Place the prepared large white board in the front of the classroom
- Place one small white board at each team's section in the classroom.

Introductory Script (~3 mins):

Welcome UQUEST scientists.

Remember the lab notebook is an important tool that scientists use to record their observations and the results of their experiments.

Let's open up your lab notebooks to the second page. Like all scientists, UQUEST scientists pay attention to the world around them. They create an environment that helps them to learn about the world. They listen to each other. They communicate with each other. And they treat each other with respect.

***Let's review the values of a UQUEST scientist. E*ach UQUEST scientist reads OUT LOUD one value.**

1. **Pay attention** when others are talking.

2. **Speak in a low voice**. Do not scream.
3. **Respect each other.** Do not push or shove each other. Wearing a mask that covers your mouth and nose shows respect for the other UQUEST scientists and keeps you and them safe and healthy.

Relaxation (~2 mins)

Before we begin the lesson, we'd like to start off by doing a relaxation activity. When scientists are relaxed, they do better science.

For today's relaxation activity we will practice belly breathing.

- Guide the UQUEST scientists, through some belly breathing for ~1 minute.

Instructions for UQUEST Guides

1. **Introduction (~20 minutes)**
    a. *What do we always do after each UQUEST activity?*
        i. *Hint – look at page 11E or 12E of your lab notebook!*
    b. *After each UQUEST lesson, we graph and document the findings from the data that we collected. Graphs are great ways to describe information and be able to communicate it to others.*
    c. Introduce statistics:
        i. *To make graphs, scientists need to understand statistics. **Statistics** are ways to summarize and describe information with single numbers.*
        ii. *Can everyone say "statistics"? Repeat after me: STATISTICS*
        iii. *Ex: if someone wants to know about the height of all the UQUEST scientists, we could tell them the height of each individual UQUEST scientist… but that would be a lot of numbers! If we wanted to use a single number to describe the height, what would we do? We would use statistics!*
            1. *We would want a number that is representative of everyone. 2 feet and 7 feet would not be good numbers because they are too extreme- very few people are 2 feet tall or 7 feet tall.*
            2. *Instead, we want a number that reflects a height that is possible and typical for all UQUEST scientists.*
    d. Introduce 2 different statistics:
        i. *There are 2 different statistics that we will discuss today. One is called the **mean**, the other is called the **median**. We will practice calculating the mean and median using this set of number cards.* **Hand one number card to each scientist (if there are less than 5 scientists, then some scientists will get more than 1 card).**
    e. *Calculate the **mean***
        i. *Another way to say **mean** is average**.** Have you heard the word average? Scientists prefer to use the word "**mean**" but it's the same as average.*

1. *The mean is a number that represents the average data.* It's like a summary of all the numbers. *Finding the mean involves doing a little math. Let's practice calculating the mean.*
2. *Let's look at all the numbers we have. We are going to find the mean of these numbers.*
3. *Read your number out loud and I will write it on our little white board.* **[Write on board the numbers].**
4. *First, to find the mean, we need to add all the numbers together. Let's add the numbers* [**add numbers together on white board]**
5. *Second, to find the mean, we need to divide that number by the number of cards total. There are 5 cards, so we have to divide the number by 5.*

f. Calculate the **median**

*i. Another statistic is called the **median**. The median is the middle number.*

*ii. If we order all the numbers from smallest to largest, we can remove one number from each side until we reach the middle. This middle number is the **median**.*

iii. Let's put all number cards in order and find the middle number by removing a card from each side

1. *If the middle is two cards (when even number of numbers), then we take the middle of these cards (middle of 3 and 4 is 3.5).*

g. Learn about seeds:

i. Today we are going to observe the number of seeds in a lemon, orange, and tangerine to practice calculating statistics. However, because we cannot eat lemon, orange, and tangerine seeds, we also brought popcorn for you all to enjoy if you would like to eat seeds as part of today's lesson.

1. **Distribute some popcorn to each scientist.**

ii. Have you ever eaten a seed before?

1. *Sometimes we eat the seeds of a fruit without even realizing it. Like on strawberries! Some fruits have one big seed in the inside, like cherries or peaches. Strawberries are one of the only fruits that have seeds on the outside.*

iii. What do you know about seeds and where they come from?

1. *Seeds can be found inside or outside of fruits and vegetables.*
2. *To grow, seeds need sunlight, water, oxygen, and a place to live.*

iv. Are seeds healthy?

1. *Seeds have a lot of nutrients like fiber, protein, vitamins, and minerals.*
2. *Fiber helps to move food through the body, protein helps build muscle, vitamins and minerals build your immune system so you don't get sick*

v. What are seeds for?

1. *Seeds are where plants grow from*
2. *The plants at the OYC garden or in your own home all started out as seeds and then grew into plants!*

vi. *Have you ever eaten any of the seeds on the coloring page on page 13A? Did you know that these are all types of seeds?*

vii. *Have you ever noticed the seeds inside of lemons, oranges, or tangerines*? *Are they big or small seeds on each fruit? What color are the seeds?*

1. *Hard, white seeds.*

2. Activity: (~20 minutes)

a. How many seeds are in a lemon or apple? Tricky question, right….?

i. *Let's figure it out!*

b. *Today, we will count how many seeds are in your fruits and then calculate the mean and median number of seeds in a fruit!*

c. *We are also going to do an observational study because we want to see if different fruits have different amounts of seeds. So, each of you will receive either a lemon, or an apple .*

d. **Hand each scientist a citrus fruit on a plate, plastic knife, tweezers, and a flashcard.**

e. **Note: each group gets one fruit; there are three groups in today's lesson**

f. Using your tweezers and plastic knife, which are tools that scientists use, carefully cut and extract the seeds in your citrus fruit onto the plate, and then count them. Write the number of seeds on your flashcard.

g. We are going to repeat what we did in the beginning of the lesson, but with our flashcards of seeds.

*h. Calculate the **mean***

i. Let's look at all your flashcards. We are going to find the mean of the number of seeds in our citrus fruit, _____.

ii. Read your number of seeds out loud and I will write it on our white board. What I write on the white board, I encourage you to also write on page 13B of your lab notebook to make your own calculations.

1. **Write on white board the numbers.**

iii. First, to find the mean, we need to add all the numbers together to find the total number of seeds. Let's add the numbers. I encourage you to try to add them on your lab notebook too!

1. **Add the numbers.**

iv. Second, to find the mean, we need to divide the total number of seeds by the number of citrus fruits. There are X scientists in this group with a citrus fruit, so we have to divide the number by X. Try to divide on your own in your lab notebook.

1. **Divide the numbers**

v. The mean number of seeds in our group is ____! Write that down on page 13B.

vi. **NOTE #1:** When calculating the mean, round to nearest whole number. We don't want precision of the calculation to mess with the overall purpose of the lesson.

vii. **NOTE #2:** When done, flag down the supervisor and have them bring your group the large white board so a scientist in your group can mark the mean bar for whatever color your group is (lemon or apple).

i. Calculate the **median**:

i. Now let's calculate the median, the middle number.

*ii. If we order all the numbers from smallest to largest, we can remove one number form each side until we reach the middle. This middle number is the **median**.*

iii. Let's put all seed flashcards in order and find the middle number by removing a card from each side. Write all the numbers in the same order from small to big on page 13B and cross out numbers from each side until you get to the middle.

1. *If the middle is two cards (when even number of numbers), then we take the middle of these cards (middle of 3 and 4 is 3.5).*

3. Documentation (~10 minutes)

a. *Now we are going to make a bar graph to document, communicate and visualize the mean number of seeds in a lemon and an apple. Please complete the bar graph on page 13C by copying the class white board onto page 13C.*

4. Discussion (~10 minutes)

1. **Now let's discuss what we did today. I will ask some questions, and if you answer, you get a sticker. At the end, the stickers can be traded in for a special prize. Let's GO!**
    i. **Award sticker for every question answered.**
    ii. **Note: below are example questions. You can ask additional questions not listed.**

2. What did we do today?

3. What are statistics?

a. Ways to summarize and describe information.

4. **Review the mean**

a. What was the mean number of seeds for a lemon? Apple?

b. Was there a difference in the mean number of seeds across the different fruits?

c. How did we calculate the mean?

i. Add all numbers and divide by total number of observations

5. **Review the median**

a. What was the median number of seeds was from notebook?

b. How did we calculate the median?

i. Ordered numbers from small to large and determined the middle number

6. What are the health benefits of seeds?

a. Not only do seeds produce healthy fruits and vegetables, but they also have their own source of nutrients, like fiber, protein, vitamins, and minerals.

b. *Fiber helps to move food through the body*

c. *Protein helps build muscle, vitamins and minerals build your immune system so you don't get sick.*

7. *What citrus fruit had the greatest mean number of seeds?*

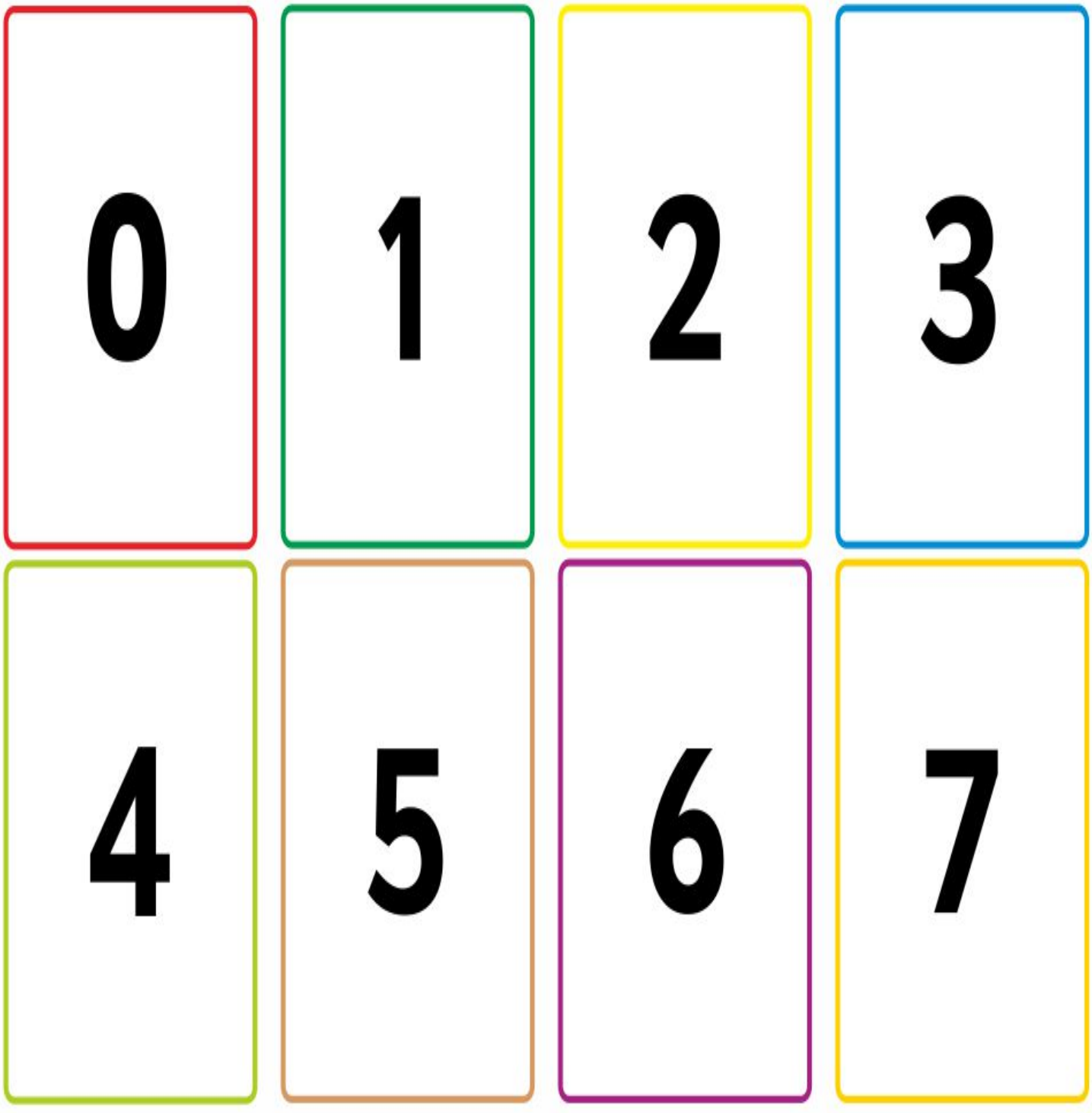
Wrap up

a. *What did you learn today? Write that down on the lines on page 13D.*
b. *How much did you like today's lesson on scale from strongly agree to strongly disagree.*
c. **Award prize at the end based on number of stickers.**

References

Inspired by/adapted from:

- Eat Smart, University of Maryland. Retrieved from https://eatsmart.umd.edu/sites/eatsmart.umd.edu/files/Lesson%205_All%20Fruits%20Have%20Seeds.pdf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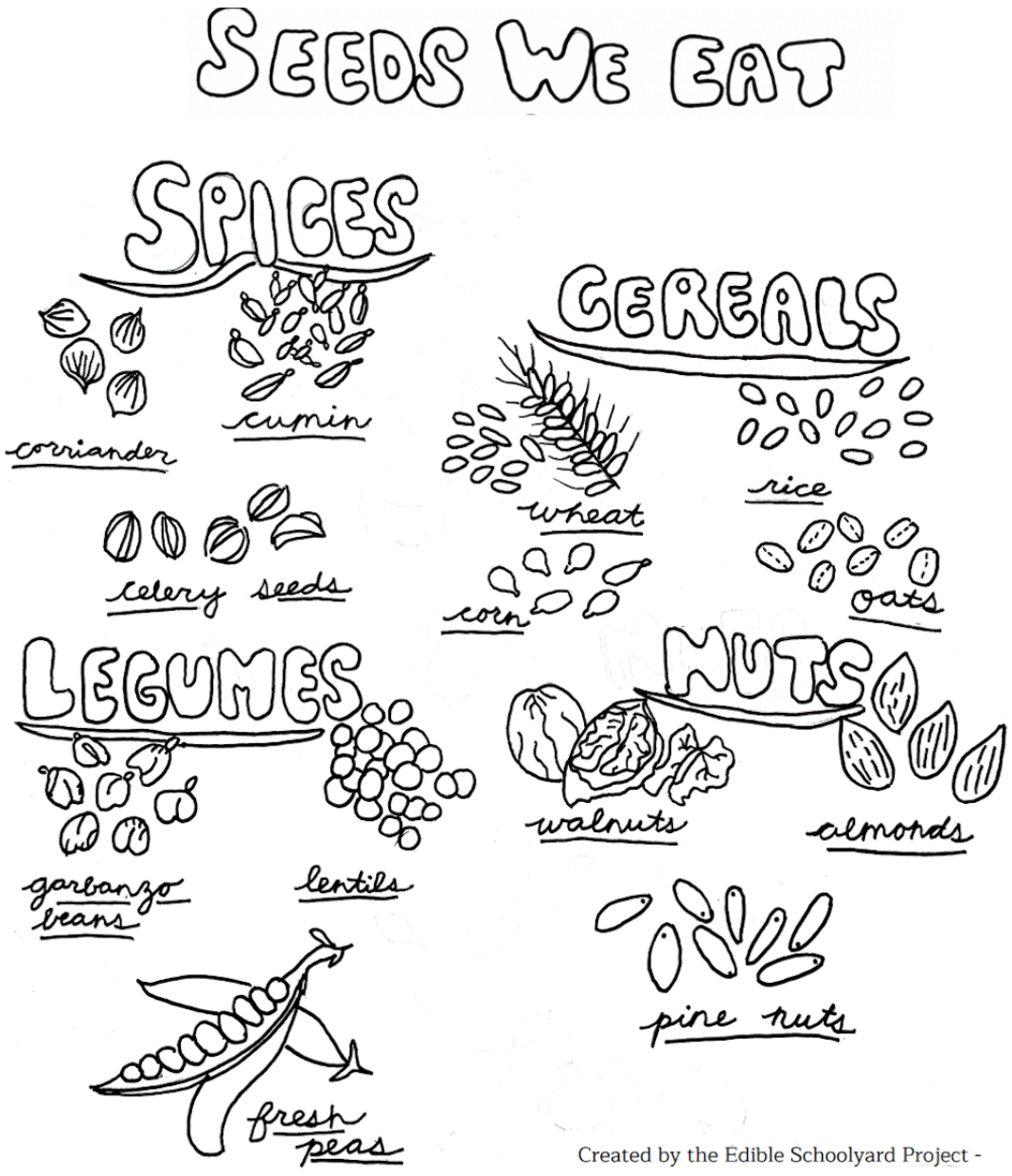
Lesson 13
Statistics of Our Seeds



Date: _____

Calculate the mean number of seeds

1. Add:

2. Divide:

3. Mean number of seeds in our group: _____

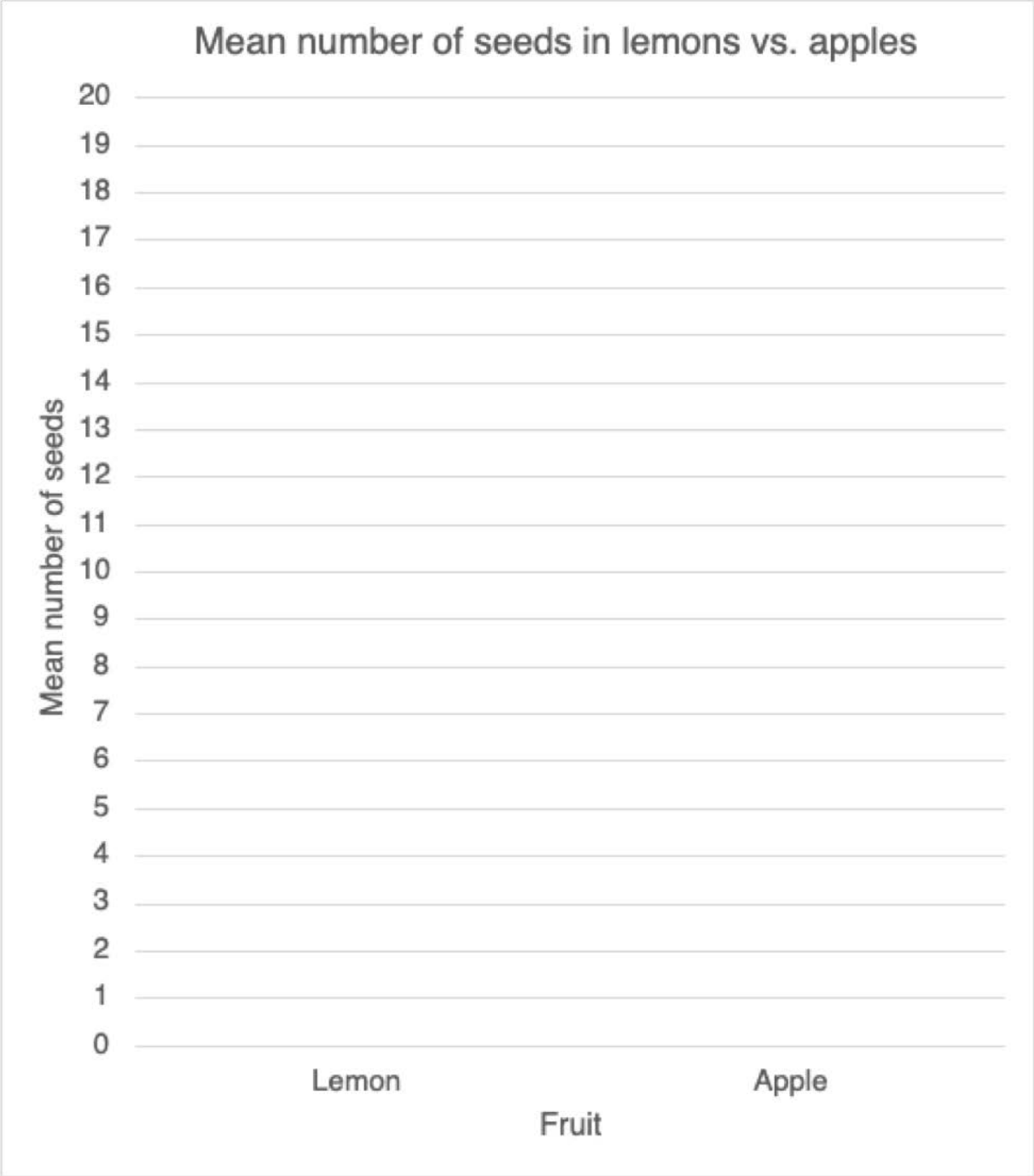
Calculate the median number of seeds

1. Write all numbers from smallest to largest:

2. Median number of seeds in our group: _____

Date: _____

Graphing



Date: _____

Lesson 13

What did I learn today?

_____

_____

_____

I liked this lesson (circle one):

Strongly Agree	Agree	Disagree	Strongly Disagree