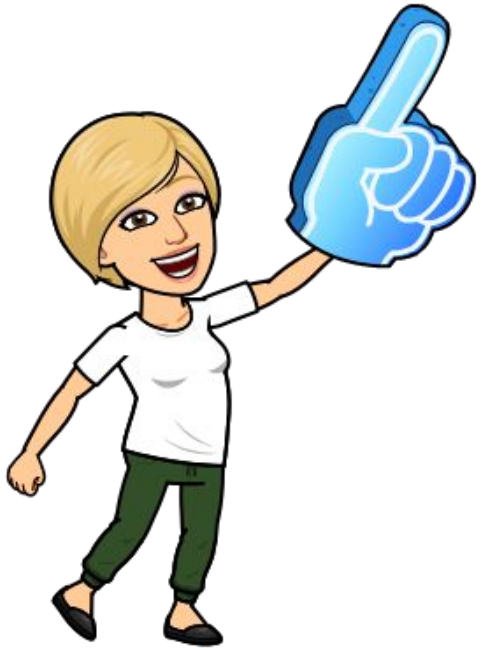
Today's Materials



- calculator
- pencil
- notebook
- glue
- highlighter

Sampling in a Fair Way

Lesson 14

CCSS Standards: Addressing	• 7.SP.A.1 • 7.SP.A.2 • 7.SP.C.7
CCSS Standards: Building towards	• 7.SP.A.1

Let’s explore ways to get **representative samples**!

Today's Goal

- ❏ I can describe ways to get a random sample from a population.

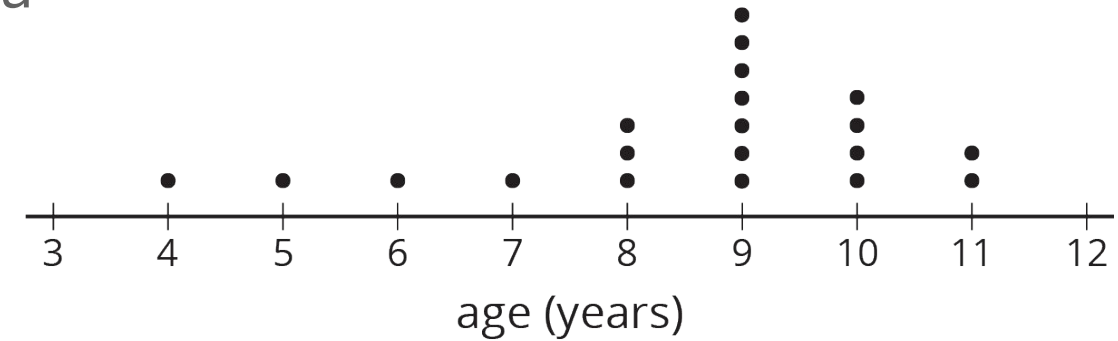
Ages of Moviegoers

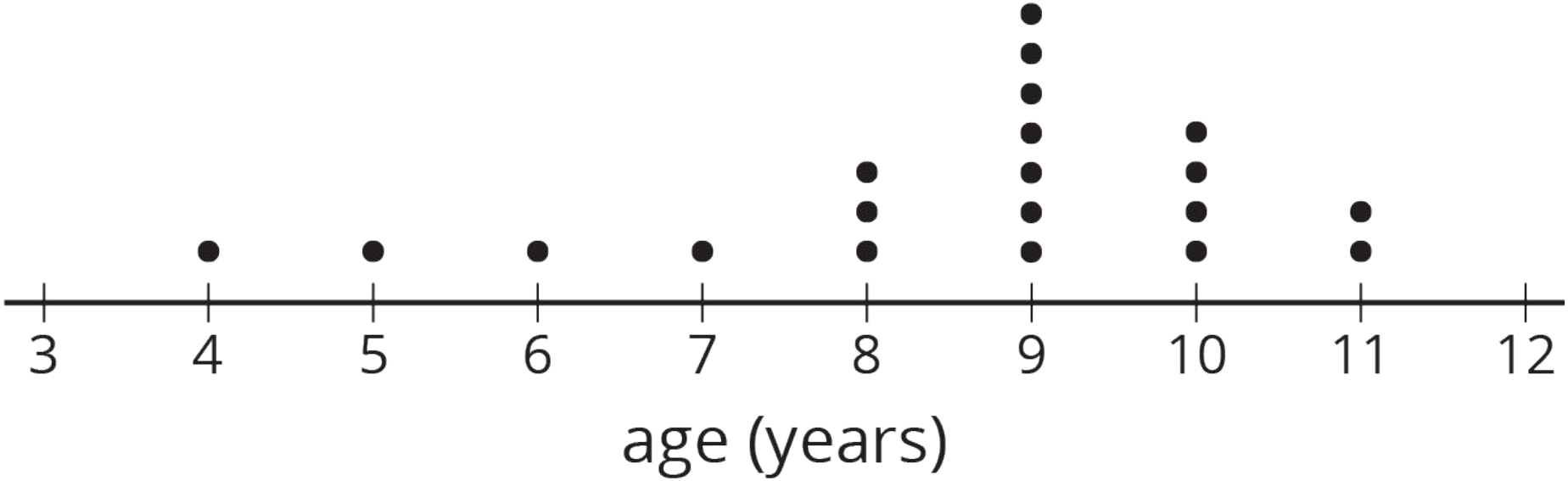
Warm Up

A survey was taken at a movie theater to estimate the average age of moviegoers.

Here is a dot plot showing the ages of the first 20 people surveyed.

1. What questions do you have about the data from the survey?
2. What assumptions would you make based on these results?




3
4
5
6
7
8
9
10
11
12
age (years)

Comparing Methods for Selecting Samples

Activity 1

- Poll the Class

Take turns with your partner reading each option aloud. For each situation, discuss:

- Would the different methods for selecting a sample lead to different conclusions about the population?
- What are the benefits of each method?
- What might each method overlook?
- Which of the methods listed would be the most likely to produce samples that are representative of the population being studied?
- Can you think of a better way to select a sample for this situation?

Lin is running in an election to be president of the 7th grade. She wants to predict her chances of winning.

Which of the given methods is best for this scenario?

What are the benefits/drawbacks for each sampling method?

Is there a better way to select a representative sample?

a. Ask everyone on her basketball team who they are voting for.

b. Ask every third girl waiting in the lunch line who they are voting for.

c. Ask the first 15 students to arrive at school one morning who they are voting for.

A nutritionist wants to collect data on how much caffeine the average American drinks per day.

Which of the given methods is best for this scenario?

What are the benefits/drawbacks for each sampling method?

Is there a better way to select a representative sample?

a. Ask the first 20 adults who arrive at a grocery store after 10:00 AM about the average amount of caffeine they consume each day.

b. Every 30 minutes, ask the first adult who comes into a coffee shop about the average amount of caffeine they consume each day.

What are some important things to consider when getting a sample?

People often have biases that may lead them to over- or under-represent some groups in their sample whether the biases are obvious or not.

Example: Sending a survey for people to respond to questions... you may not reach people who do not have email addresses!

Due to the (sometimes hidden) biases, the best method for selecting samples is to remove as much of the personal selection as possible.

In the rest of this lesson, we will explore methods for generating samples that avoid biases.

That’s the First Straw

Activity 2

I need 5 volunteers to help me with a demonstration!

- One at a time, each student will reach into the bag and remove **the first straw piece they touch**.
- Measure the straw piece to the nearest half inch and announce it to the class to record on their activity paper.
- Return the straw and shake the bag.
- Pass the bag to the next student.
  (Each student will draw twice.)

Now work as a team to complete the remainder of the task!

- What would it mean for a process of selecting straws to be “fair?”
- Was this selection process fair?

Check out the lengths of straws in the bag!

length of straw in inches	$\frac{1}{2}$	1	2	3	4	5
number of straws	6	6	8	6	5	4

- Were your samples representative of the contents in the bag?
- Did every straw in the bag have an equal chance of being selected?
- If we increased the sample size to 10, would that make the sample more representative?

A larger sample does not help the estimate if the selection base is flawed!

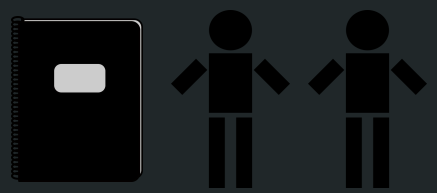
Example:
If someone uses the heights of 40 basketball players instead of only 20 basketball players to determine the average height of everyone in the United States, the larger sample probably doesn't represent the population any better.

Although the process may seem random since we took out as much of the human element of the choosing process as possible, the longer straws were over- represented in our samples.

It is important to try to anticipate all the different ways that the selection process might be biased to avoid it as much as possible.

That’s the Last Straw

Activity 3



The straws from the previous task are numbered with 1 representing the shortest straw and 35 representing the longest.

What would it mean for this sample method to be **fair**?
Can you think of a way of sampling that would be **fair**?

straw number	length (inches)
1	0.5
2	0.5
3	0.5
4	0.5
5	0.5
6	0.5
7	1.0
8	1.0
9	1.0
10	1.0
11	1.0
12	1.0
13	2.0
14	2.0
15	2.0
16	2.0
17	2.0
18	2.0
19	2.0
20	2.0
21	3.0
22	3.0
23	3.0
24	3.0
25	3.0
26	3.0
27	4.0
28	4.0
29	4.0
30	4.0
31	4.0
32	5.0
33	5.0
34	5.0
35	5.0

Begin this activity on your own!
Then we'll discuss our ideas as a class.

random sample

Which of the 4 methods from your activity paper is a **random sample**?

a sample from a population that is selected in a way that gives every different possible sample of the same size an equal chance of being selected

The most common straw in the bag was the 2 inch straw.

When selecting one of the straw **numbers** (not lengths) at random, what is the probability of selecting a 2 inch straw?

8/35 **0.23** **23.86%**

A **representative sample** would have more of the common lengths, and there is also a higher probability of selecting these lengths, so a **random selection** should be a good way to select a representative sample.

A **random sample** does not guarantee a representative sample, but it avoids methods that might over- or under-represent items of the population.

Since we do not know the data for the population, a random sample usually provides the best opportunity to get a **representative sample**.

While it is the most ideal method, it is not always possible to generate a **random sample**.

For example, if you wanted to know the average size of salmon in the wild, it is impossible to know how many there are, to identify them individually, select a few randomly, and capture and measure them.

In these cases, it is important to try to intentionally reduce **bias** as much as possible when selecting a sample.

“Are you ready for more?

Computers accept inputs, follow instructions, and produce outputs, so they cannot produce truly random numbers. If you knew the input, you could predict the output by following the same instructions the computer is following. When truly random numbers are needed, scientists measure natural phenomena such as radioactive decay or temperature variations. Before such measurements were possible, statisticians used random number tables, like this:

Use this table to select a sample of 5 straws. Pick a starting point at random in the table. If the number is between 01 and 35, include that number straw in your sample. If the number has already been selected, or is not between 01 and 35, ignore it, and move on to the next number.

85 67 95 02 42 61 21 35 15 34 41
85 94 61 72 53 24 15 67 85 94 12
67 88 15 32 42 65 75 98 46 25 13
07 53 60 75 82 34 67 44 20 42 33
99 37 40 33 40 88 90 50 75 22 90
00 03 84 57 91 15 70 08 90 03 02
78 07 16 51 13 89 67 64 54 05 26
62 06 61 43 02 60 73 58 38 53 88
02 50 88 44 37 05 13 54 78 97 30

What makes a sample selected at random the best way to select individuals for a sample?

It avoids biases that might be introduced using other methods.

As part of an English project, you want to look at the length of lines in Shakespeare's plays.

What are some methods of selecting a random sample of lines from these plays?

- **Assign each line a number.**
- **Select random numbers that match the lines (computer, bag...).**

Today's Goals

- ❏ I know that selecting a sample at **random** is usually a good way to get a **representative sample**.
- ❏ I can describe ways to get a random sample from a population.

Sampling Spinach

Cool Down