



Lesson Activity: Potential Problems with Sampling

AP[®] Statistics

Duration Approximately 40 minutes

Materials Needed

- Student copies of Abraham Lincoln’s speech, “The Gettysburg Address”:

Abraham Lincoln: The Gettysburg Address
The following speech is in the public domain.
President Abraham Lincoln delivered the following speech on November 19, 1863, at the dedication of the Soldiers' National Cemetery in Gettysburg, Pennsylvania.

Four score and seven years ago our fathers brought forth on this continent, a new nation, conceived in Liberty, and dedicated to the proposition that all men are created equal.

Now we are engaged in a great civil war, testing whether that nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battle-field of that war. We have come to dedicate a portion of that field, as a final resting place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this.

But, in a larger sense, we can not dedicate—we can not consecrate—we can not hallow—this ground. The brave men, living and dead, who struggled here, have consecrated it, far above our poor power to add or detract. The world will little note, nor long remember what we say here, but it can never forget what they did here. It is for us the living, rather, to be dedicated here to the unfinished work which they who fought here have thus far so nobly advanced. It is rather for us to be here dedicated to the great task remaining before us—that from these honored dead we take increased devotion to that cause for which they gave the last full measure of devotion—that we here highly resolve that these dead shall not have died in vain—that this nation, under God, shall have a new birth of freedom—and that government of the people, by the people, for the people, shall not perish from the earth.

(full-size included at the end of the lesson activity)

- Notebook paper/pencils
- Chart paper/classroom whiteboard

College Board[®] Standards

- **3.4:** Potential Problems with Sampling
- **1.C:** Describe an appropriate method for gathering and representing data.

Activity Objectives

DAT-2.E: Identify potential sources of bias in sampling methods.



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Activity Instructions

- 1. Give** each student a copy of “The Gettysburg Address” and tell them the goal is to efficiently determine the average word length. **Ask** students to identify the population of interest (all 268 words in “The Gettysburg Address”). **Ask** for ideas about how to determine the average word length. *(Note: Students may suggest determining the length of every single word, then suggest a more efficient approach where they can use a sample of the words.)*
- 2. Ask** Students to circle five favorite words from any part of the speech. Using the five words they circled, **ask** each student to find the average word length of their data sample. **Record** each student’s average word length on a piece of chart paper or a classroom whiteboard.
 - What do students notice about the averages?
 - Is it easy to gauge what the true mean of the speech’s word length is from this sample? Why or why not?
 - What role might potential bias play in this process?
- 3.** Next, **ask** students how they could use random selection to choose 5 words for their sample (systematic sampling, assigning a number to each word in each sentence and then using a number generator/dice to select words, stratified sampling, etc). Then, **ask** students to use a random sampling method to create their sample of five words from any part of the speech. Using their five circled words, **ask** each student to find the average word length of their data sample. **Record** each student’s average word length on a piece of chart paper or a classroom whiteboard.
 - What do students notice about the averages?
 - Is it easy to gauge what the true mean of the speech’s word length is from this sample? Why or why not?
 - What role might potential bias play in this process?
- 4.** Finally, **ask** students to use random selection to circle 15 words from any part of the speech. Using their 15 circled words, **ask** each student to find the average word length of their data sample. **Record** each student’s average word length on a piece of chart paper or a classroom whiteboard.
 - What do students notice about the averages *now*?
 - Does the size of the data set affect the true mean of the speech’s word length from this random sample? Why or why not?

Guiding Questions

What are some common methods of sampling?

What are the potential problems and sources of bias that can arise with sampling?

How can we ensure that our sample is truly representative of the data as a whole?



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Possible Variations

- Instead of “The Gettysburg Address,” have students use the lyrics to a popular song, poem, or a well-known text to complete the activity.
- Have students listen to a song or poem instead of reading a text and ask them to write down their word choices instead of circling them on a page.
- Ask students to create a visual representation of the data set they believe best demonstrates the true mean for the average word length and include a written justification of their thinking.
- At the conclusion of the activity, disclose the true mean of the text used (e.g., “The Gettysburg Address” has an average of 4.295 letters/word). See how the students’ calculations compare with the true mean.

Lesson Extension

The following UWorld questions can be used for additional practice, a quick formative assessment, homework, or small group interventions:

- 801481, 801549, 801634, 801635



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