

How Many E's?

Purpose

Students will describe that the larger the sample, the more accurately it represents the whole and will understand that any sample can be poorly chosen and this will make it unrepresentative of the whole.

Materials

For the teacher: chalk; chalkboard; picture that contains an area with too many objects to count directly, such as stars, a rock covered with barnacles, etc.

For each student: ruler, scissors, $\frac{1}{4}$ sheet of cardstock, pencil, copy of Black Line Master (BLM) *Oh the E's!*

For the class: Sunday newspaper with text, comics, and advertisement pages

Activity

A. Pre-Activity Discussion

1. Show students the picture and ask students if they can determine how many [*insert name of objects*] there are in the picture.
2. Explain that there are many times when it is not possible to directly count every object in an area, and therefore we have to use sampling techniques to estimate the number of objects.
3. Ask students to brainstorm ways they could estimate the number of [*insert name of objects*] in the picture.
4. Tell students that scientists use many different techniques to estimate numbers of objects, but today they will be using random sampling of smaller areas to estimate the number of objects in a larger area.

B. Newspaper E's

1. Give each student a $\frac{1}{4}$ sheet of cardstock, a ruler, and scissors.
2. Have each student draw a 4 cm \times 4 cm square in the middle of his/her cardstock. Direct each student to cut out the square so that he/she produces a 4 cm \times 4 cm frame through which to look.
3. Give each student a copy of the BLM *Oh the E's!* and a page from the Sunday newspaper. Make sure that several students get text pages and several get comic or advertisement pages.
4. Tell students that they will estimate how many times the letter *e* appears throughout the newspaper. Instruct students to follow instructions 1 through 8 on the BLM *Oh the E's!* to estimate the number of *e*'s on their page.

(continued)

connecting
across the
curriculum



Mathematics

Have students analyze their data in other ways, such as determining range and mode, and then have students graph the differences in number of *e*'s per page for different types of pages.

MEETING
INDIVIDUAL
NEEDS



Have students who need a challenge conduct a survey outside to estimate the number of students on school grounds or number of cars in the parking lot, etc., without counting them directly.

Standards Links
7.1.1, 7.2.2

Activity (continued)

5. Allow ample time for students to complete their investigations.




C. Sampling Error

1. Direct each student to record the results from his/her page on the chalkboard.
2. As a class, estimate the number of *e*'s in the newspaper (steps 9 through 11 on the BLM).
3. Divide the class into four random groups and have each group recalculate the total number of *e*'s using only their own results.
4. Ask students which estimate they think is more accurate: the one produced by the entire class or the one produced by the smaller groups.
5. Explain that the larger the sample size, the more accurately it represents the whole. Tell students that this is because a larger sample size reduces the chance that one very high or one very low sample will distort the average.
6. Divide the class by the type of page they received. Have each group recalculate the total number of *e*'s and record their data on the board.
7. Ask the class if the new estimates are closer to or farther from the original class average.
8. Ask students if they think it is accurate to pick only cartoon or advertisement pages to estimate the total number of *e*'s in the entire newspaper.
9. Explain to students that since one type of page does not represent the whole newspaper, sampling from just one type of page does not give an accurate representation of the entire newspaper.
10. Tell students that this is true for any sample. For example, explain that if we wanted to know the average height of the students in the class, sampling only the girls or only the boys would be unlikely to give an accurate representation of the entire class.

Classroom Assessment

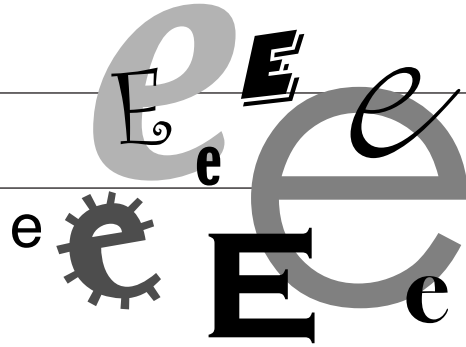
Basic Concepts and Processes

After the class has calculated the various sets of averages, ask questions, such as:

-  Does a large or small sample size give a more accurate representation of the whole?
 -  Is random sampling better than sampling from specific groups?
 -  How do you know this?
-

Name: _____

Oh the E's!



Directions:

1. Draw a 4 cm \times 4 cm square on your cardstock.
2. Cut out the square to create a frame.
3. Determine the area of the window of your frame and record the area in A below.
4. Determine the area of your page of newspaper and record the measurement below in B.
5. Determine how many of your frames it takes to make a page by dividing the total area of your page by the area of the frame and record the information in C.
6. Toss your frame onto the newspaper in a random location four times, count the exact number of *e*'s present in the frame, and record your data in D.
7. Determine the average number of *e*'s in a frame and record the average in E.
8. Determine the approximate number of *e*'s on the page by multiplying the average *e*'s in the frame (E) by the number of frames in a page (C) and record the information in F.
9. Determine the average number of *e*'s on a page from the entire class's data and record it in G.
10. Count the total number of pages in the newspaper (H).
11. Multiply the average number of *e*'s per page (G) by the number of pages in the newspaper (H) to determine the total number of *e*'s in the newspaper.

Data

- A. Area of frame = _____
- B. Area of my newspaper page = _____
- C. Number of frames per page = _____
- D. Number of *e*'s per frame
Count 1: _____
Count 2: _____
Count 3: _____
Count 4: _____
- E. Average Number of *e*'s per frame: _____
- F. Estimate of number of *e*'s on a page: _____
- G. Average number of *e*'s per page as a class: _____
- H. Number of pages in the newspaper: _____
- I. Total number of *e*'s in the newspaper: _____

Summarize the Data

Number of *e*'s as a class:

Number of *e*'s as a group:

Number of *e*'s on my page:

Which estimate is the most accurate for the entire newspaper?

Oh the E's!

Teacher Directions

Provide students with the BLM *Oh the E's!*, cardstock, rulers, scissors, and pages of newspaper. Have students follow the instructions on the BLM *Oh the E's!* to determine the number of *e*'s in a newspaper.

Answer Key

Answers will vary; however, ensure that students have accurately completed their calculations.