

Stellar Sampling: How Quickly Can You Count the Stars?

Target Standard

Problem Solving

- Build new mathematical knowledge through problem solving
- Apply and adapt a variety of appropriate strategies to solve problems
- Monitor and reflect on the process of mathematical problem solving

Related Standard

Number and Operation

- Compute fluently and make reasonable estimates

Prior knowledge

- Experience with estimation
- Experience with calculators (optional)

Teaching Plan

Purpose

To develop and use strategies to estimate the results of whole-number computations and to judge the reasonableness of such results

Materials

Star Map

Calculators (optional)

Index cards folded in half or Post-It™ notes

Transparency of graph paper (larger for 3rd graders)

Sampling the Stars activity sheet:

Implementation

1. Display the **Star Map**. Teacher should explain that this is just a portion of the sky. Not all stars are visible with this view. Some of the stars that appear as a single point of light are actually a binary system (two stars).
2. Students guess the number of stars visible on the star map. This guess is written (large enough for class to see) on an index card, with fold at the top so it will stand on the desk (child's name is written on inside). If you use Post-It™ notes, these can be stuck to chalk or white board.
3. Two children place all the guesses in numerical order (smallest to largest) on a string suspended in front of classroom.
4. Discuss the range, looking at these numbers (range is the difference between the greatest and smallest guess).
5. Ask the students if there are any guesses that float too far out of the range. Discuss that these are outliers. Outliers can affect the way you interpret your data.
6. Ask the students if there are any numbers that have been guessed twice. Any repeated numbers are hung on top of each other. The mode is the most repeated guess. (There may be one, more than one or no mode.)
7. Place repeated mode cards back in order. To find the median, select two children to assist. One child begins at low end of guesses, the other child begins at the high end of the guesses. They each pick off one number at a time, until they reach the center. This center number would be the median. If you have an even number of guesses, the median would fall between the two middle guesses.

8. When calculating the mean use calculators if appropriate for your age group. The teacher can call out each guess, while each child enters the guesses, adds, then divides by the number of guesses. (Older children could do this independently.)
9. Compare mode, median and mean. These are all types of averages. How do these numbers vary and why? Give students the opportunity to change guesses after this discussion.

Discussion: Sampling the Stars

Discuss strategies for estimating a more accurate total for the number of stars – highlight the enormously time consuming nature of counting every star in the star field. Guide students to the idea of sampling.

Example: if we want to estimate the number of students in our school, we could estimate that each class has 24 students (or use the number of students in your class). Tell students what sampling is: a number of people, objects, or events chosen from a given population to represent the entire group.

1. Arrange students in groups of four. Do one complete sampling method as follows.
2. Each student will be responsible for one fourth of the **Star Map**. Distribute the **Sampling the Stars** activity sheet for students to record their responses.
3. Discuss strategies for keeping track of stars that have been counted (highlighter, circling, numbering, tallying, etc.) Have individual children silently count stars in their portion of star map.
4. After counting the stars in their quarter, estimate the total number of stars on the map.
5. Children are given the opportunity to adjust their original guess.
6. Discuss how these revised estimates affect the range. (The numbers should be closer together. An estimate is made when the estimator has more information and the estimate is closer to the real number, therefore there should be few or no outliers.)
7. Groups will add to determine total number of stars.
8. Compare this information with the adjusted estimates.
9. Brainstorm other ways to take a sampling. Is there a better way? A quicker way? *Example: divide into thirds, eighths, use a transparency with a grid to take a sample from one portion of the grid and then multiply by number of boxes, etc.*

Extensions

The teacher could point out that some of the stars in this view are actually binary systems (two stars close together). Not all of the stars are visible in this view.

Name:

Sampling the Stars

	Individual Sample	Total Estimate	Range of Estimate	Adjusted Estimate	Actual Estimate	Difference: Estimate-Actual
Individual						
Team						

How else might you come up with a total number of stars?

Star Map

