

## Ask the Stats Fan: I Feel like I Should be Teaching Statistics, but Where Do I Start?

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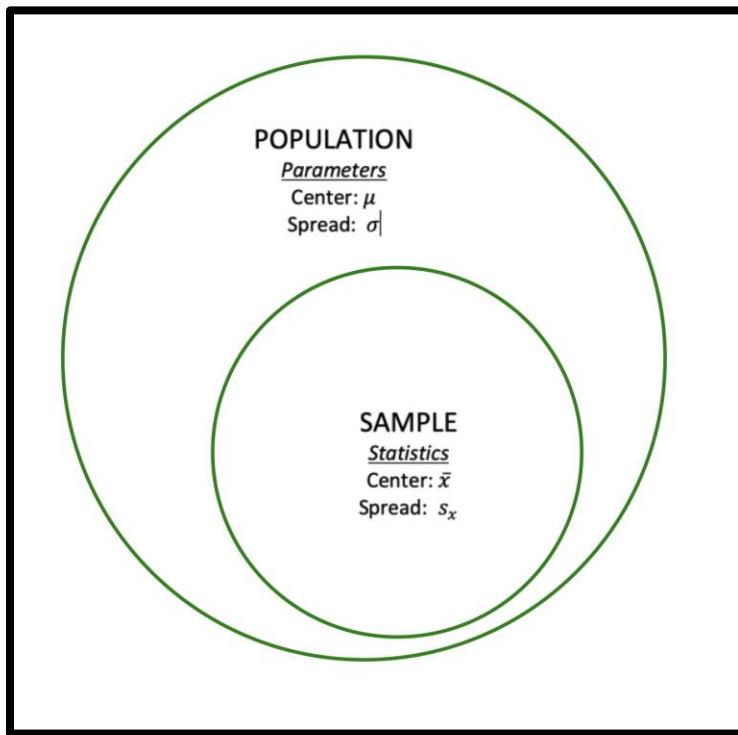


In issues to come, I will highlight some aspects of statistics and simple ways to fold them into existing curriculum. If you have any particular questions about Stats, feel free to **Ask the Stats Fan!** by emailing [rmiller@Kentdenver.org](mailto:rmiller@Kentdenver.org) with Ask the Stats Fan in the subject line ☺

Ruth Miller is the Head of the Math Department at Kent Denver School in Englewood, CO. From 2011 to 2019, Ruth was the Chair of the Department of Mathematics and Computer Science at Greenhills School in Ann Arbor, and Ruth also spent part of that time as the Region II Representative to the Michigan Council of Teachers of Mathematics Board of Directors. She is an AP Calculus Reader. Table Leader. and Consultant. and has also taught AP Stats off and on since the course's inception.

Every math teacher has been cornered at a party and heard a story about the horrors of a college stats class. Sometimes this has happened with other math teachers! We went into math usually because we enjoyed Algebra, and school math has often treated probability and statistics as something we attend to when we have “finished” with the rest of the curriculum (as if that ever has happened). The trick is to treat Stats as a natural application of the work we do with the curriculum; to see Stats as an extension of the Measurement Strand; an approach that the Common Core used when it took NCTM’s Measurement and Data Analysis Curriculum strands and developed them into the CCSSM’s Modeling and Statistics & Probability strands.

This makes a lot of sense, because Statistics is the science of using a sample to measure the attributes of a population. There is a saying, “Who knows what is really happening with the population? Only God!” For example, we use a census to try to enumerate the population of the US, but we suffer under no illusions that we have actually arrived at the number of folks living in the US. Only God knows (and, I sometimes add, She’s not telling...). The measures of center and spread of a population (the mean,  $\mu$ , & standard deviation,  $\sigma$ ) are called the *parameters* of the population, and the measures of center and spread of the sample (the sample mean,  $\bar{x}$ , & sample standard deviation,  $s_x$ ) are called *statistics*. So doing Stats is about using the measures of a sample to guesstimate the behavior of a population. Once you have internalized this understanding, it becomes easier to phrase questions and conversations: Pick a graph or a headline and ask your class, “How did the authors get the sample, and what population does the sample represent? What can we infer about the population from what the sample tells us?”



Here are some examples:

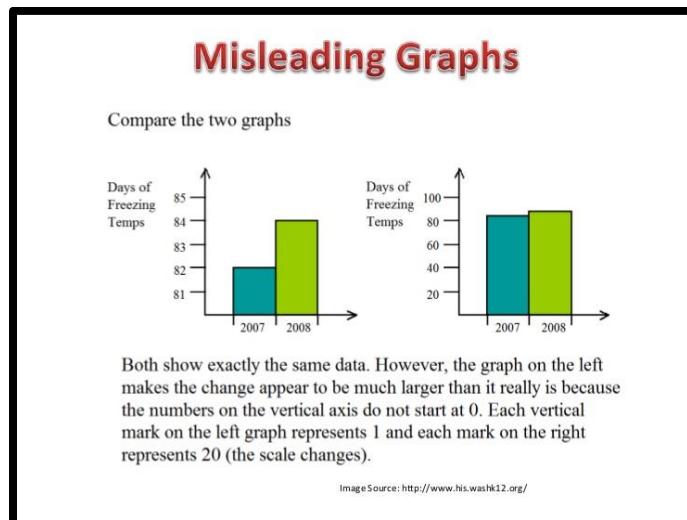
- Every **K-2 classroom** seems to have a poster of how many teeth have been lost by month. Have the kids look at this poster and
  - Note-
    - This poster is only about our class, not about every 1<sup>st</sup> grade class in the world
    - If I'm in our class, then my tooth loss is reflected on this poster
  - Question-
    - What if I'm a first grader in another class at our school? Can I expect to have a similar tooth loss experience?
    - If our class lost 4 teeth in October, and another class lost 3 teeth in October, is that “about the same” or “different?”
    - What if I'm a first grader in a class in Germany? Based on our class's experience, what would we expect?
    - How could we find out if we are right about our answers?
- **Intermediate grades** can look at graphs they find in the news or online, a google search with the “images” tab highlighted will provide a million (literally) examples.
  - At this age, ask the kids to try to find the source of the information and to write sentences that compare the results using the appropriate populations, based on the sample. For the graph below, for example, “Based on a survey of 800 women, more women dislike folding laundry than dislike sorting laundry.”



- Ask the students what they cannot say, based on this information- the sample here, for example, consists of women; do we know anything about how men feel about these tasks?
- Sentence writing using phrases like “more than, less than, most, and least” are great ways to introduce students to comparisons.



- In **Middle School**, students worry about right and wrong, and social justice; it's a perfect time to think about the lies that can be told with Statistics! Look for questionable axes, small sample sizes, confusing headlines that try to, for example, assert that a conclusion based on a sample from a small town represents how “Americans” feel about an issue. Google searches for “Misleading Graphs” will yield a gold mine, and USA Today is known for bad graphs- have the kids try to find the error!



- **High School** students are ready for some sophisticated thinking about the ways that a sample can (or cannot) represent a population. For example, if you want to find out how

Americans feel about the Second Amendment, you are not likely to get a good representation of the population of “Americans” if you only sample members of the National Rifle Association. You would, however, get a great representation of the population of “NRA Members.” Polls conducted by political parties, by magazines, by Facebook; these usually have a bias and will often purport to represent populations that have no relation to the makeup of the sample. Ask students to do a deep dive in the back of a poll to find out exactly where the sample came from, and compare that to the narrative in the front of an article about what the author claims is true about which population. The website 538 has a page devoted to rating pollsters for bias <https://projects.fivethirtyeight.com/pollster-ratings/>; and if you have a little time there is an activity called Random Rectangles that is amazing in terms of showing why random samples work better than most other samples to get to the “truth” about a population. [https://link.springer.com/chapter/10.1007/978-1-4757-3843-8\\_21](https://link.springer.com/chapter/10.1007/978-1-4757-3843-8_21)

#### Some Resources about Stats Curriculum:

<https://www.nctm.org/News-and-Calendar/Messages-from-the-President/Archive/Trena-Wilkerson/Statistics-Education -An-Imperative-for-Our-Future/>

[https://www.nctm.org/uploadedFiles/Standards\\_and\\_Positions/Pre-K-12\\_Guidelines\\_GAISE%20II\\_Final.pdf](https://www.nctm.org/uploadedFiles/Standards_and_Positions/Pre-K-12_Guidelines_GAISE%20II_Final.pdf)

[https://www.nctm.org/uploadedFiles/Standards\\_and\\_Positions/Common\\_Core\\_State\\_Standards/Math\\_Standards.pdf](https://www.nctm.org/uploadedFiles/Standards_and_Positions/Common_Core_State_Standards/Math_Standards.pdf)

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