Promoting Meaningful Statistics Teaching: Moving from Calculating to Investigating

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NCTM April 5, 2019
Presentation Outline

- Consider differences between mathematical and statistical reasoning
- Identify characteristics of good statistics tasks
- Analyze statistics tasks using statistics task guide
- Resources to support teacher learning -- using statistical tasks to promote statistical reasoning
Why support teachers’ professional learning in statistics teaching?

- Statistics is prominent in secondary curricula (National Council of Teachers of Mathematics, 2000; National Governors Association Center for Best Practice & Council of Chief State School Officers, 2010)
- Teachers often have limited experiences in statistics education (Burrill & Biehler, 2011)
- Trained in programs that do not support becoming effective statistics teachers (Zieffler et al., 2018)
- ASA recommends critical need for teachers to use evidence-based practices in teaching statistics (Franklin et al., 2015)
“To successfully develop students’ statistical thinking, teachers must have deep knowledge and understanding of statistics and the way that students learn statistics. Consequently, the need is critical for high-quality preservice and in-service preparation and professional development that supports pre-K–12 teachers of mathematics, new and experienced, in developing their own statistical proficiency as well as their students' understanding of and skill in working with statistics.”

http://www.nctm.org/Standards-and-Positions/Position-Statements/Preparing-Pre-K-12-Teachers-of-Statistics/
Why focus on tasks?

Interrelated Dimensions of Learning Environment that Supports Statistical Thinking

- Focus on central ideas
- Students’ statistical thinking
- Well-designed tasks
- Discourse & argumentation
- Real or realistic data
- Technology Tools
Mathematics vs. Statistics

How is mathematics different than statistics?

Think: 1 min
Pair: 2 min

Share (whole group): 3 min
Statistical Habits of Mind

- Critical role of context
- Issues of measurement
- Variability and uncertainty of conclusions
- Important role of sampling
- Use of visuals (graphical representations) and numerical statistics to find trends
- Skepticism about claims and interpretations based on data
Phases of Statistical Investigation:
Moving from Calculating to Investigating

Enhancing Statistics Teacher Education with E-Modules
Using Habits of Mind in Phases of Statistical Investigation

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<th>Pose Questions</th>
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<td><strong>Context</strong>: Ask contextually-based questions that call for the use of data to answer.</td>
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<td><strong>Variability</strong>: Seek to explain and control variability.</td>
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<th>Collect Data</th>
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<tr>
<td><strong>Measurement</strong>: Consider how to best measure attributes in a context for answering a question.</td>
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<td><strong>Measurement</strong>: Use appropriate tools (physical and online) to collect and manage data.</td>
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<td><strong>Sampling</strong>: Consider sample size – it matters.</td>
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<td><strong>Sampling</strong>: Use random sampling to help control bias.</td>
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<td><strong>Sampling</strong>: Identify and account for sources of potential variability in data collection methods.</td>
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<th>Analyze Data</th>
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<td><strong>Visuals</strong>: Use appropriate tools strategically for creating multiple representations.</td>
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<td><strong>Variability</strong>: Coordinate graphs and statistical computations to reason about distributions in the aggregate.</td>
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<td><strong>Trends</strong>: Look for patterns and relationships within and among variables.</td>
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<td><strong>Context</strong>: Consider context of your question to identify measurement issues (missing data, outliers).</td>
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<th>Interpret Results</th>
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<td><strong>Context</strong>: Reason quantitatively and make arguments supported by data.</td>
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<td><strong>Context</strong>: Make a claim connected to the context of the questions.</td>
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<td><strong>Uncertainty</strong>: Account for uncertainty in a claim (be confident but not certain).</td>
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<td><strong>Skeptic</strong>: Check the reasonableness of a claim (skepticism)</td>
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Discuss

• Do you have a task that you use that you think promotes engaging in and developing statistical thinking?

• What are characteristics of tasks that provide opportunities to engage in statistical thinking?
What makes a good statistical task?

Watch as statistics education experts discuss:

Panelists:
Hollylynne Lee
(NC State University)

Chris Franklin
(K–12 Statistics Ambassador for the American Statistical Association)

Maryann Huey
(Drake University)

Roger Woodard
(University of Notre Dame)
Considerations for Design and Implementation of Statistics Task (CDIST) Framework

tinyurl.com/CDISTguide
Engage in one of the task sets with a partner.

- What was it like to engage in each task?
- How do these tasks compare – how are they similar/different?
- What are the opportunities to engage in statistical habits of mind and phases of an investigation for each task?
- Does one task offer more or better opportunities to engage in and develop statistical thinking?

Resources to Support Teacher Learning

ESTEEM: Enhancing Statistics Teacher Education through E-Modules (NSF DUE 1625713)

hirise.fi.ncsu.edu/projects/esteem

More resources to support teacher learning from Hub for Innovation and Research in Statistics Education (HI-RiSE) -- see Resources

hirise.fi.ncsu.edu

Professional learning opportunities (free) for educators

place.fi.ncsu.edu
What is needed to support teachers in your local school/district in learning to use tasks to engage students in statistical habits of mind and phases of an investigation?

https://tinyurl.com/StatTaskLearningGuide
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This project is supported by the National Science Foundation under Grant No. DUE 1625713 awarded to North Carolina State University. Any opinions, findings, and conclusions or recommendations expressed herein are those of the principal investigators and do not necessarily reflect the views of the National Science Foundation.

hirise.fi.ncsu.edu/projects/esteem/