

### ESTEEM Webinar for Teacher Educators: Implementing the Foundations in Teaching Statistics and Supporting Inferential Reasoning Modules

Hollylynne Lee NC State University

November 19, 2019 11:15am-1:00pm EST



# Webinar Goals

- Learn about Key updates in Summer 2019
- Hear from 3 faculty implementers!
- Experience a few key ESTEEM activities and think about scaffold and connections across modules



# To access and share ESTEEM modules

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Open the following link:

https://place.fi.ncsu.edu

### Direct link to ESTEEM page

https://place.fi.ncsu.edu/local/catalog/course.php?id=22&ref=3





**Principal Investigators:** 

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# **ESTEEM Modular Approach**



# Structure of a Module

Each Module has 2 Parts. Each part about 5-8 hours of materials

Each Part has 3 Sections:

Read & Watch

- Essential Materials: Readings, videos and quizzes or interactives
- Learn from Practice: videos with teachers and students!

Engage with Data

- Active statistics investigation using CODAP or other tools
- Focus on pedagogical aspects of investigations

Synthesize & Apply

 Activities, reflections, discussions that help teachers connect ideas and apply to practice of teaching



# Key updates in Summer 2019

- All pages have clickable ESTEEM logo on it and Creative Commons License to enhance clarity on how materials can be used and adapted.
- More support for using CODAP
- Description of classroom videos include more context about students and where this video is situated in their studies.
- Minor edits throughout that were reported by faculty users



- Revised investigation in **1.1g** to highlight role of a case in a dataset.
  - New PDF and new CODAP file. Removed TUVA
- New 1.1i (no TUVA --only on actions in CODAP
- **1.2g** investigation (revised questions in PDF)
- 1.2.h focus PSTs on critical aspects of one pair
- **1.2.i** now 3 parts with tighter focus on discourse.



# Major Updates to Mod A B & Assignments:

In both Mod A & B, we have made purposeful attempts to connect back to material from Mod 1 and build from it!

- Mod A & B have strong content focus to ensure teachers learn critical pedagogy along with develop better understandings of statistical concepts for teaching
- Now a COMPLETE Part 2 for both!
- Task Design--better directions and suggestions
- Screencast -- choices of datasets and questions to pursue updated to not overlap with major investigations in modules.



# Learning From Faculty!

Nina Bailey

**Kristin Lesseig** 

Liza Bondurant





# Nina Bailey



Context

- Undergraduate Introductory Statistics Course for the Social Sciences
- Face-to-face
- •1 Future Teacher
- •19 students in the class

#### **ESTEEM Materials Used**

- How is Stat & Math Different? (1.1.a)
- Investigating Older Roller Coasters (1.1.g)
- Habits of Mind (1.1.b)
- Investigating More Roller Coasters (1.2.g)
- Investigating Fair Die: Schoolopoly (A.1.f)

# Schoolopoly Adaptations

- Had students play with fair and unfair die before starting
- Challenged students to use the fewest number of samples/sample size they deemed appropriate to make their decision
- Each small group presented their findings on a poster sticky
- The class voted on which sticky presented the best evidence
- Online discussion forum on "What constitutes quality evidence?" as homework

# Schoolopoly Challenges

- Students mostly understood that variation was expected
  - Conceptions of how much varied drastically
  - While they knew variation was expected, they did not tolerate it well
  - Focused on expected value and frustrated with variation
- Less tolerant of variation when voting
  - Winner was the one with the most uniform histogram
  - Winner had a small number of samples with a small sample size
- Different ideas of how much data was necessary to make an informed decision

# Schoolopoly Proud Teacher Moments

- Strong emphasis on looking at sample size, effect size, and quality of evidence in statistical arguments evidenced for the rest of the semester
  - Many kept referencing schoolopoly and the discussion that took place in the online forum
- When we dived into formal inference
  - Less major misconceptions
  - Better discussion around sampling distributions
- Stronger argumentation





# Kristin Lesseig



# TchLrn 463 Teaching concepts in probability & statistics

#### KRISTIN LESSEIG WASHINGTON STATE UNIVERSITY VANCOUVER



### Context

• 1<sup>st</sup> of 5 courses in middle level mathematics endorsement program

- 6 week summer course
- 3 hrs 2 days a week
- 22 students across 3 sites

• Vancouver - Juniors in first summer of 2-year BA elementary teacher prep

### Content

#### Foundations Module

#### • Teaching Statistical Association Module

- Task Design Assignment
  - Final course project

### • Hybrid mix of online / in class assignments

• Supplemented with exercises in "stats for k-8 educators"(Rosenfeld, 2013); readings from EU series, (NCTM); and MTMS articles

### Feedback...

• Something that was technology based that I really liked that was implemented in this class was CODAP. I thought that it was super useful.

- The assignments challenged me to think about the statistics of the real world. However, we
  had more modules that made me wish we had less of and more instructional time.
- I enjoyed revisiting statistical ideas and proper ways that I could teach these concepts to students.
- I wish that there was more teacher guidance for doing the modules. I don't like that it is assigned for us to do on our own. I would love for the class to be able to ask questions before getting going or the teacher to do a couple with us to give a expectation of what were supposed to answer.

#### Teaching Probability & Statistics

#### Difference between mathematics and statistics:

- Statistics: you are dealing with a sample of data and its context and within this data there is variability and uncertainty.
- Math: certain outcomes and there may or may not be context or background with the problem.

#### IMPORTANT PARTS OF STATS:

- Context
- Visual representations
- Distribution
- Measures of center
- Relative frequency
- Association

#### Visual

#### **Representations:**

- Tables
- Graphs
  - Pie chart
  - Bar graph
  - Scatterplot
  - Line graph

#### Measures of center:

- Mean: The average of the values in a data set
- Median: The middle value in a sample space
- Mode: The most common value in a data set

Context The background story of the data

> Distribution A whole set of numbers in a sampl space

ASSOCIATION Whether the variables in the data share a

#### Relative Frequency Representation of the distribution of the data Ex: can be a probability





# Liza Bondurant



Used full Introductory Module with my Methods for Teaching Secondary Math class





# 1.1.c Considering the



Importance of Teaching

🔊 Edit

Published



View All Pages



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Part 1. What is statistics and why should we teach it?

Experts in statistics education gathered for a panel

#### Lessons learned:

I)Do it BEFORE their field experiences and unit planning. Why? The module changes their habits of mind overall about teaching and learning math. They will write and teach lesson plans that are applied and involve investigations /analyzing instead of lecture/practice lessons. 2. Before doing the ESTEEM intro module talk to students about: the future job market and how that should impact their teaching (see below). Hurting students with traditional lecture/practice. Students need to investigate/analyze applied problems share:

Freakenomics podcast "America's Math Curriculum Doesn't Add Up" https://podcasts.apple.com/us/podcast/freakonomics-radio/id3546 68519?i=1000452107231

Ted talks "Teach statistics before calculus!" <u>https://www.ted.com/talks/arthur\_benjamin\_s\_formula\_for\_chan</u> <u>ging\_math\_education?language=en</u>

#### Info supporting a (above):

According to "The Future of Jobs Report" 50% of companies expect that **automation** will lead to some reduction in their full-time workforce by 2022. The career skills that are in demand now and will be in demand in the future are changing. <u>http://www3.weforum.org/docs/WEF\_Future\_of\_Jobs\_2018.pdf</u>

Today, 2018	Trending, 2022	Declining, 2022
Analytical thinking and innovation	Analytical thinking and innovation	Manual dexterity, endurance and precision
Complex problem-solving	Active learning and learning strategies	Memory, verbal, auditory and spatial abilities
Critical thinking and analysis	Creativity, originality and initiative	Management of financial, material resources
Active learning and learning strategies	Technology design and programming	Technology installation and maintenance
Creativity, originality and initiative	Critical thinking and analysis	Reading, writing, math and active listening
Attention to detail, trustworthiness	Complex problem-solving	Management of personnel
Emotional intelligence	Leadership and social influence	Quality control and safety awareness
Reasoning, problem-solving and ideation	Emotional intelligence	Coordination and time management
Leadership and social influence	Reasoning, problem-solving and ideation	Visual, auditory and speech abilities
Coordination and time management	Systems analysis and evaluation	Technology use, monitoring and control

Source: Future of Jobs Survey 2018, World Economic Forum.

#### The above addition strengthen the WHY argument.

#### The Introductory module teaches PSTs:

- I. How stats is different from math (my PSTs did not realize this)
- 2. How to teach statistics/what statistics is (news to my PSTs, they viewed it the same as math, didn't understand differences)
  - a) Provides exemplar Rollercoaster investigation using CODAP
  - b) Do the investigation as student and see video of students doing investigation (best practice to do assignments yourself as a teacher)
    c) I also did the investigation with my Quantitative Reasoning gen ed math class. They did better working in partners on it. They had a lot of questions.

I assigned reading, quiz, and online discussion for homework (Thursday due Tuesday). Did investigation in class and had follow up discussions in class (on Tuesday).

### **Revisiting Foundational Module**

What are key ideas brought forth in the foundational module?

Let's look at changes made!





# Inferential Reasoning: Modeling, Sampling, and Sampling Variability

# using the Sampler in CODAP



# Task Design Assignment

<u>**Purpose</u>** - this assignment provides an opportunity for PSTs to design a task that develops students' statistical thinking utilizing CODAP as a tool.</u>

- Implemented after the Association and/or Inference Modules
- Key parts of other modules that lead up to this assignment
  - 1.2c 1.2j
  - A.2d A.2g
  - B.2g





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