Critical Learning Experiences for Preparing Teachers of Statistics

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HI-RiSE: A Hub for Innovation and Research in Statistics Education

Laying foundations for future data scientists and data literate citizenry

- **Collaborative** in our work
- **Connected** to classrooms and teachers
- **Committed** to open educational resources
Context

• **US Curriculum**: Higher expectations for statistical content
• **Higher Education**: Interest and tools for online learning increasing
• **Teacher Education**: Greater emphasis on learning based on practices of teaching
• **Practicing Teachers**: Feel overwhelmed and tend to marginalize statistics. *ASA a true positive influence here!!*
• **New Teachers**: Feel least prepared to teach statistics and demonstrate weak understandings (Lovett & Lee, 2017; 2018)
Live Outside My Comfort Zone and Go Big!

Commitment to, and designing for, online professional development and teacher education

Two recent efforts and one on the horizon!
Two MOOCs for Educators Aimed at Better Instructional Strategies

- 4500+ registered
- 2100+ in Unit 1
- 800+ completed

Funded by William and Flora Hewlett Foundation
Enhancing Statistics Teacher Education with E-Modules

3 modules

In 2018-19
20+ courses
17+ institutions

100+ registered in online portal

Funded by NSF (DUE 1625713)
Professional Change Model and Triggers for Critical Reflection

- Change process includes reflection and enactment among external domain and teacher's professional world (Clark & Hollingsworth, 2002)
- Mezirow’s (2009) theory of transformational learning to examine stimuli that act as triggers to evoke cognitive dissonance for teachers where they question their understandings & perspectives from prior experiences

Clark & Hollingsworth (2002)
What impacts on teacher’s learning can happen in online environments?

What experiences seem to matter most?
STE Online Design Features

CONTENT

• Framing Based on GAISE and Research on Students’ Learning
• Use of Free and Accessible Tools for Data Investigation
• Investigation of Engaging, Real, Larger, and Messy Data Sets
• Connection to Classroom Practice through Videos, Tasks, Frameworks
• Value Learning from Multiple Voices

DELIVERY

• All Units or Modules have Same Organization & Structure
• Simplify Access & Delivery
• Use Multimedia
• Prompt Meaningful Interactions
Supporting Students’ Approaches to Statistical Investigations

GAISE-inspired framework
Multimedia Learning Opportunities

Brief Papers

Instructor Video with Explanations and Examples of Students’ Reasoning

Clickable Diagram

Expert Panel Discussions

Using Technology to Make Sense of Real Data

Classroom Videos
Connection to Classroom Practice

Expert Panel Discussions
Teacher Interviews
Classroom Videos
Videos of Student Work with Tools
Expository Videos
Meaningful Tasks
Impacts on Beliefs, Perspectives & Instructional Strategies

What resources triggered these shifts?
Data Sources

**MOOCs**
- Discussion forums
- Surveys: *unit, end-of course, 6 month follow-up*
- Interviews

**ESTEEM**
- Discussion Forums
- Post-Surveys
- Interviews
Coding for Impact and triggers for teachers’ learning

- “From the second video [Multiple levels of sophistication] it is apparent that each group of students investigating whether the die was fair or biased were at different levels of the SASI framework. The ways in which each group collected and analyzed data and interpreted the results indicated their levels of statistical sophistication.”

- “I loved the video of Chris and HollyLynne talking about the mean [Developing the concept of mean]. It is helping me to get a big picture idea of the curriculum.”

- “The SASI framework and example of statistical tasks [Dive into Data] were very useful to design, initiate statistical inquiry in classrooms. The SASI framework helped in becoming more objective and observant in what is going [on] in the classroom, where each group/child is heading and what are gap areas to be worked upon.”
Impacts on Perspectives about Statistics and Teaching Statistics

Understanding of **key statistical practices** and how these practices are connected rather than perpetuating statistics as a set of tools and procedures.

Ability to **explore and learn from data**, impacting their perspectives on how **useful explorations with data could be for students**.

Awareness of how **instruction should engage students** in various aspects of a **statistical investigation cycle**.

Understanding of how **technology tools support learning** from real, sometimes messy, and **bigger data**.
Moving beyond formulas

“I am comfortable with mathematics in general, but I was not comfortable with statistics....My biggest lesson learned was not to be afraid of data. I think that is something I am past now. Using real data, using bigger data sets, and not being so focused on “but can you do it by hand?”. I think that was my biggest block with statistics as a math person is that so much of it actually is not meant to be calculated by hand.” --ESTEEM Preservice teacher, Fall 2018 interview
Confessions about beliefs and practices

While listening to the "expert panel" and reading the posted articles at the beginning of the unit, I had a "lightbulb moment". Although I have been teaching HS math for 24 years, I have never actually taught "statistics" as defined by the members of the expert panel. I have taught units that I THOUGHT were statistics, but I was merely providing students with a few mathematical tools that statisticians [sic] can use (e.g. finding a mean, making a histogram, calculating a standard deviation, etc.).

Chris said that math teachers oftne [sic] jump right to the "analyze phase" with a given set of data without ever posing any meaningful questions, looking at how the data was collected, or even why it was collected. That sounds way too much like what is going on at my school for students who only expereince [sic] "stats" in our Algebra 2 course, and don't go on to the college level course we offer. Web added that this practice "trivializes" statistics. Ouch!! Guilty as charged!!...” --TSDI Fall 2015 classroom teacher
Questions and Investigations Matter

“The mooc prompted me to rethink what sorts of questions I ask students, shifting more to statistical reasoning questions and away from statistical processes” - TSDI Fall 2015 Participant

“The biggest lesson that I learned was about the role that a teacher can play in the investigative process that students go through. Teachers can pose questions that put students on a new path to investigate new data or to help students analyze a set of data differently.” ESTEEMM preservice teacher survey
Importance of All Investigative Phases

“Thinking of statistics as a cycle has really helped me have a stronger understanding of Statistical thought. Rather than just having students complete a page of computational type questions, it really needs to be an ongoing cycle of thinking, investigating, considering, and then rethinking. I am going to start using Pose, Collect, Analyze, and Interpret as prompts in the classroom.” - TSDI Spring 16 Classroom Teacher
Investigating real data with CODAP

“Being able to go ahead and do it on my own and seeing how it can be used and also seeing a video of a teacher doing that in the classroom, I think 10 years down the road, if I've forgotten everything else, I will definitely remember CODAP and how useful that is and try to implement something similar into my classroom.”

-ESTEEM preservice teacher survey
Triggers Influencing Changes

SASI Framework

Classroom Videos of Teachers & Students

Expert Panel and Teacher Discussions

Engaging with Colleagues

Using Technology to Make Sense of Real Data

Classroom tested Tasks/Lessons
Critical Learning Experiences

Framing experiences in a cycle, habits of mind, & levels
Engaging with data with easy to use tools
Hearing importance and strategies from experienced others
Seeing and reflecting on students’ and teachers’ experiences
Being critical about elements of tasks that matter
The Future....

InSTEP: Invigorating Statistics Teacher Education through Professional Online Learning

- Design personalized pathways for MS and HS teachers
- Dashboards, recommendation engines, microcredentials
- 2.9 million (DRK-12) 4 yrs
- Partner with RTI’s Center for Technology to build platform

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Access to all projects and free materials!!
Trends in MOOC Activity
Unit Participation Across 7 Sections

- Some skipped orientation and went straight to Unit 1, others came to orientation and did nothing else.
- 33% of those in Unit 1 made it to Unit 5!
- 278 accessed a certificate

2723 unique registrants
1744 enrollees (64%) showed up!
Most view 8 or less days and have less than 90 resource views

User 9663

Female, masters degree, 10 yrs exp, K-12 classroom teacher, NC

User 10215

User 5731

User 9663

5731: 15 yrs exp, masters degree, female, college faculty, MD

10215: 10 yrs exp, male, doctoral degree, college faculty, MI

9663 Super Visitor and Resource User! 5 yrs exp, PhD, female, College faculty, Hungary, only 4 forum posts!