How a MOOC for Educators Can Make a Large Impact

Hollylynne Lee Gemma Mojica
Christina Azmy Heather Barker
NC State University

THE WILLIAM AND FLORA HEWLETT FOUNDATION

NCTM Research Conference 2019

THE WILLIAM & IDA FRIDAY INSTITUTE FOR EDUCATIONAL INNOVATION

Introduction: Why Online Professional Development?

It is “incumbent on the field to capitalize on emerging technologies in the design and delivery of effective professional development” and contribute “research that [is] focused on teacher learning in these environments” (Marrongelle, Sztajn & Smith, 2013, p. 208).

- Some PD models have moved online to take advantage of scale and affordances of the web (Dede & Eisenkraft, 2016).
- Free and open PD can reach more teachers across geographic boundaries (Kim, 2015; Kleiman, Wolf, & Frye, 2015).

MOOCs for Educators at the FI

place.fi.ncsu.edu

MOOC-Ed: Massive Open Online Courses for Educators

- Course Open — Teaching the Beauty and Joy of Computing Curriculum
- Registration Open — Teaching Foundational Reading Skills
- Registration Open — Coaching Digital Learning
- Registration Open — Teaching Mathematics with Technology
- Registration Open — Teaching Statistics Through Inferential Reasoning
- Learning Differences
- Problem Solving in the Digital Age
- Teaching Statistics Through Data Investigations
- Fraction Foundations
- Disciplinary Literacy for Deeper Learning

THE WILLIAM AND FLORA HEWLETT FOUNDATION

Research-based Design Principles of Effective PD and Online Learning

- Self-directed learning
- Peer-supported learning
- Job-connected learning
- Learning from multiple voices

(Kleiman, Wolf, & Frye, 2015)

Why an online PD in teaching statistics?

- Statistics has gained prominence in curricula (NCTM, 2000; Common Core, 2010; GAISE, 2007; SET, 2015).
- Teachers have limited experiences in statistics education (Burrill & Biehler, 2011; Zieffler et al., 2018) and preservice teachers do not feel prepared (Lovett & Lee, 2017) and are not strong in high school content (Lovett & Lee, 2018).

Teaching Statistics Through Data Investigations http://go.ncsu.edu/tsdi

- First launched Spring 2015
- FREE – funded through grant from Hewlett Foundation
- Designed for teachers of students age 12 through introductory college courses (focus on pedagogy)
- Goal is to equip teachers with tools, frameworks, resources, and skills to teach statistics as an investigative process with real data

Overview of Research Paper

- Theoretical Foundations and Framework
  - Designing Online Professional Development
- Online Course Context
- Methods
  - Participants
  - Data Collection and Analysis
- Results
  - Engagement with the External Domain
  - Impacts on Confidence to Teach Statistics
  - Triggers and Impacts in their Beliefs and Perspectives
  - Impacts on Teachers as Continuous Learners
- Discussion and Significance of Research

Key Components of Each Unit

- **Engage with Essentials**: brief papers and short videos
- **Learn from Experts**: expert panel and interview videos
- **Dive into Data**: tasks using free open tools (TUVA, CODAP)
- **Investigate and Discuss**: pedagogy focused (assessment, task analysis, student work, confidence to teach)
- **Discuss Learning and Practices**: exchange of ideas on various topics initiated by participants
- **Extend your Learning** - content videos, readings, lesson plans
- **Demonstrate your Learning** - microcredential opportunities

Multimedia Learning Opportunities

Brief Paper

Framework for Supporting Students' Approaches to Statistical Investigations
A Guiding Framework for the Teaching Statistics through Data Investigations
Hollylynne Lee and Dung Tran
Friday Institute for Educational Innovation
NC State University

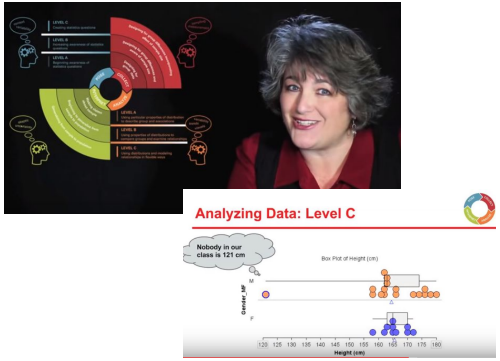
Data is omnipresent in everyday life, and students need to be prepared to make educated decisions when confronted with data in their lives. Learning statistics can assist students in developing data literacy skills and productive ways of reasoning to make sense of data. Students need opportunities to be involved in doing statistics – engaging in the statistical investigation process. These experiences should develop the sophistication of students' data investigation abilities and foster ways of reasoning that promote habits of mind involved in statistical thinking. To help teachers support students, we designed the Students' Approaches to Statistical Investigations [SASI] framework. The SASI framework is adapted from the Guidelines for Assessment and Instruction in Statistics Education at K-12 and college, endorsed by the American Statistical Association, which incorporates research on students' statistical thinking and productive statistical habits of minds.

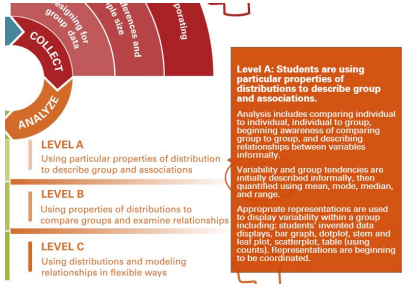
The four phases typically used in a statistical investigation--posing a question, collecting data, analyzing data, and interpreting results--are at the core of the SASI framework. While these phases are often done in that order, they can also be non-linear and cyclic in nature. For example, one may start with a set of data that has already been collected, do some preliminary exploration of the data, then pose a targeted question involving only a few variables in the data set. From there, they merely need to select the appropriate data for the variables of interest and proceed to the analysis phase.

Productive statistical habits of mind are interwoven throughout the SASI framework. A habit of mind is developed when a person approaches situations in similar ways so that a more general heuristic is accumulated over time. The framework focuses on specific habits of mind that are productive for engaging in statistics. The framework also describes growth in statistical sophistication, from level A to C. The levels do not necessarily correspond to grade levels. As students are beginning to learn to conduct investigations, regardless of age or grade level, they should have experiences that allow them to grow in their statistical sophistication. The details in the levels are meant to provide guidance of reasonable expectations of students at each level. Thus, the level descriptions can be used to guide task development, instruction, and assessment. It is assumed that students working at level C within a phase of a statistical investigation are also able to incorporate understandings from levels A and B. Likewise, at level B students are able to incorporate ideas from level A.

The following pages provide more details about the statistical habits of mind and a description of what students are able to do within a statistical investigation at the three levels.

Instructor Video with Explanations and Examples of Students' Reasoning





Clickable Diagram

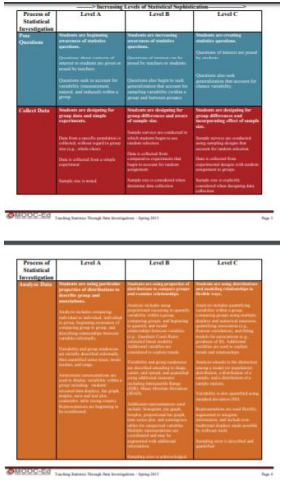


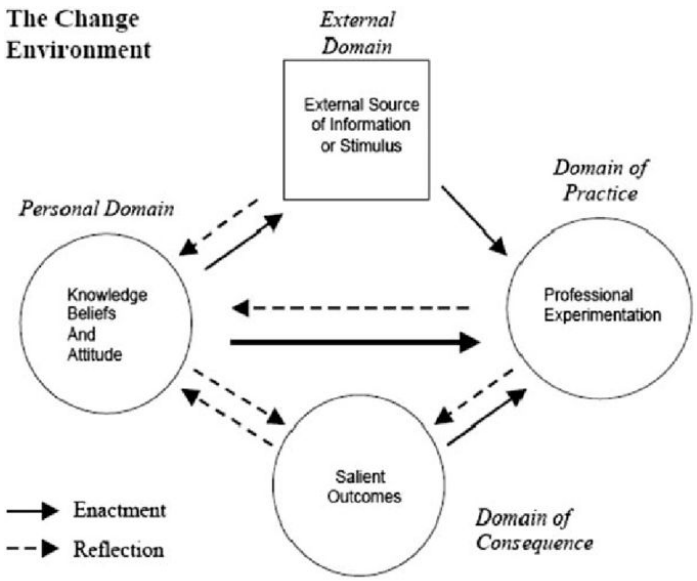
Table with Explanations

Research Question

How can a MOOC specifically designed for educators impact teachers' beliefs, perspectives, and teaching practices regarding statistics?

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)

How to Measure Impacts on Practice from a MOOC-Ed

Measures in MOOCs

- Track course engagement--click logs
- Retention rates
- Quiz or final assessments
- Opinion surveys

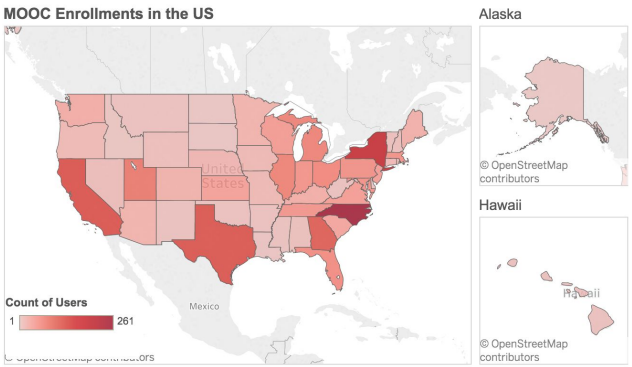
Measures of Impact of PD

- Conversations during PD
- Artifacts of practice
- Pre-post assessments
- Follow-up surveys
- Interviews
- Observations of practice
- Student outcomes

Methods and Results

Participants

- 6 sections (Fall 2015 to Fall 2017)
- 2,527 educators from 84 countries
  - 78.8% from US
- 66.4% female
- 61% identified as classroom teachers
- 54% masters, 18.8% doctoral degrees
- Mean of 14 years of experience
  - 20% with 1-5 yrs and 20% with more than 20 yrs



Methods

Previous Work

Fall 2015

- Posts (n=977) from classroom teachers using open-coding (Lee, Lovett & Mojica 2017)
- 4 themes identified describing changes in teachers' perspectives/beliefs
- Posts re-examined and tagged for evidence of what was triggering the changes

Data Collected

Fall 2015-Fall 2017

- SETS (pre- & post-surveys)
- Click Log Data
- Unit 5 Discussion Forums
- Unit 5 & Follow-up Surveys
- Interviews

Analysis

SETS & Click Log Data

- SETS (pre- & post-surveys) – paired t-test & gain scores
- Descriptive statistics and graphical displays

Discussion Forum Data & Unit 5 Survey

- 721 posts analyzed from Unit 5 discussion forums coded for themes previously identified; Unit 5 survey analyzed
- 4 new themes emerged describing changes in teachers' perspectives/beliefs
- After saturation in data and no new themes emerged, confirmed codes in the remaining three courses

Follow-up Survey & Interviews

- Follow-up survey & interviews coded for themes of change and triggers
- Sought confirming/dis-confirming evidence using open coding to endure no new themes emerged

Results

Engagement in External Domain

Confidence to Teach Statistics

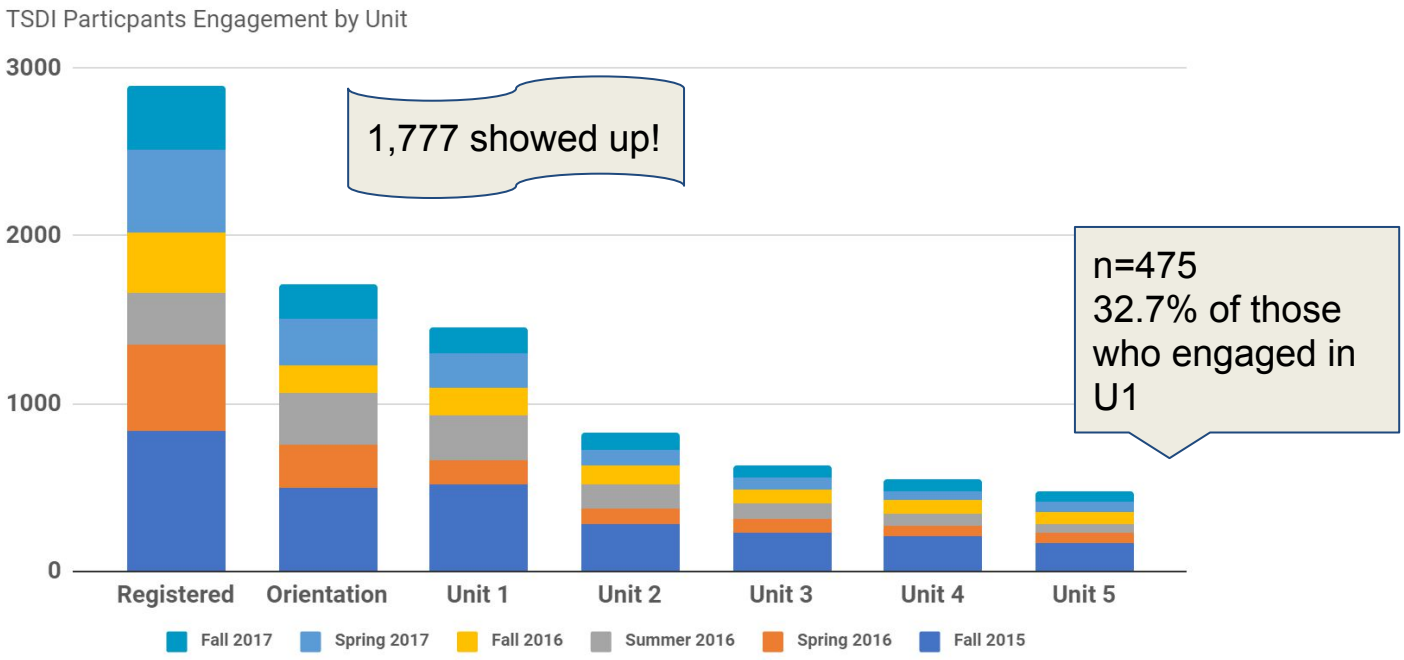
Impacts on Beliefs and Perspectives

Triggers for Impacts

Impacts on Educators as Continuous Learners

Engagement with External Domain

How do participants engage in OPD?



How do participants engage in discussions?

Participants accessing course (n=1,777)

- 980 posted in forum (55%)
- 2,165 discussion forum threads, 6386 total posts
- Avg. 6.65 post/partic., some posted 30-50 times

Instructional staff (n=10 across all sections)

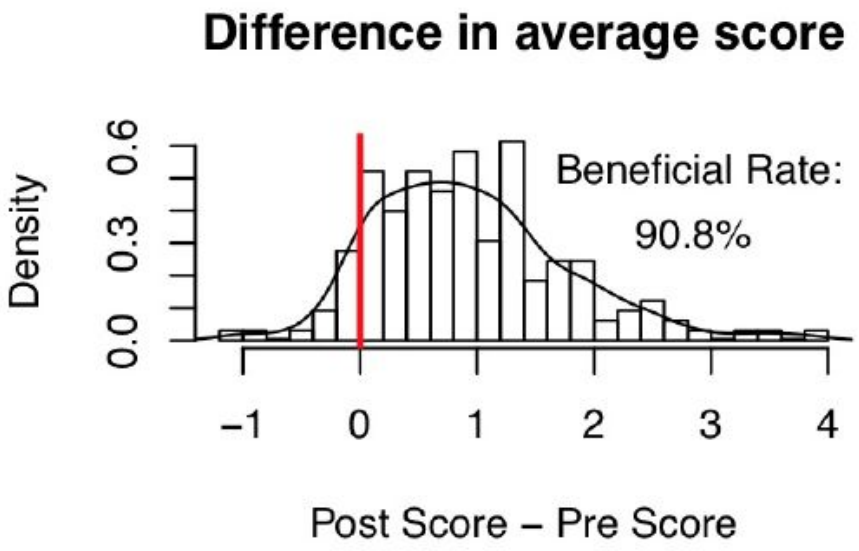
- 461 discussion threads, 568 posts
- Vast majority from lead instructor, Lee

Confidence to Teach Statistics

Self Efficacy for Teaching Statistics

(Harrell-Williams, et al. 2019)

- n=163 participants took pre- and post-survey
- Pre-mean score = 3.90
  - SD = 0.43
- Post-mean score = 4.84
  - SD = 0.29
- Paired t-test supports increase in confidence



SETS Survey Responses

Increase in Confidence

I feel much more confident regarding statistics now. Prior to this course, I had very little to no familiarity with statistics. The ***videos and practice with the data sites like Census for School*** *really made everything concrete for me. I'm looking forward to bringing these ideas into the classroom.* -Spring 2016 participant

Decrease in Confidence

I think the biggest thing this MOOC did was to ***open my eyes.*** *And, if the confidence scores are lower now, it might be due to me* ***having a deeper understanding, and knowing more about what I DON'T know about.*** *Like the "ignorance is bliss" quote.*

-Fall 2017 participant

Impacts on Beliefs & Perspectives

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**

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

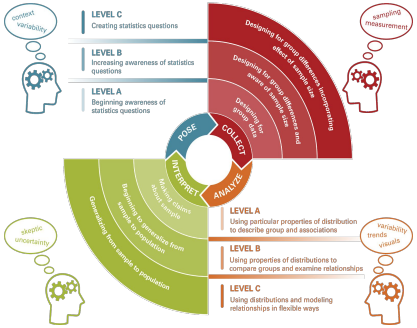
*"The mooc prompted me to rethink what sorts of questions I ask students, **shifting more to statistical reasoning** questions and **away from statistical processes**" -Fall 2015 Participant*

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

*"**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**." -Spring 16 Participant*

Triggers for Impacts

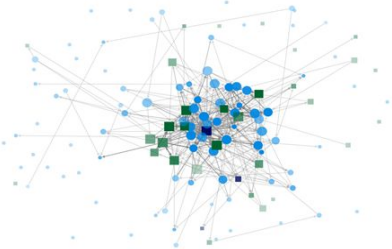
Triggers Influencing Changes in Perspectives



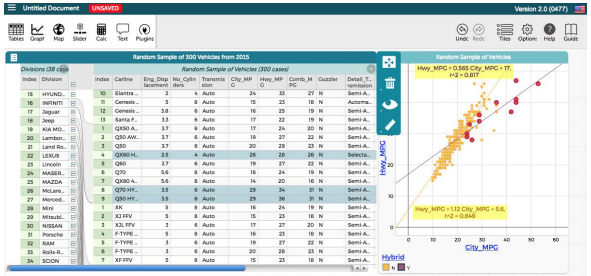
SASI Framework

Classroom Videos of Teachers & Students

Expert Panel Discussions



Engaging with Colleagues



Using Technology to Make Sense of Real Data

Value of Course for Changing Practices

- Access to plethora of resources
- Flexibility for learning on their own time
- Ease of using material directly in their classroom

Impacts on Continuous Learning

Teachers as Continuous Learners

Share resources and new ideas with colleagues in both informal and formal ways to create systemic change

Informal ways

- Shared resources with colleagues
- Leading reform-oriented discussions with school colleagues

Formal ways

- Designed new lesson plans, implemented and submitted to STEW
- Translated key resources into Spanish and Mandarin
- Authored a blog about her professional learning in TSDI
- Returned to take second Teaching Statistics MOOC (n=323)

Implications

- Courses like TSDI have the ability to engage many educators
  - 33% completion rate much higher than other MOOCs (5-20%, Perna et al., 2014)
- Even educators who did not complete the course showed evidence of reflection and were impacted by engagement with specific course resources in early units
- A course like TSDI has potential to increase educators' confidence to teach statistics
- Well-designed resources (e.g., SASI) and engaging with peers can impact educators' beliefs and perspectives
- Participants moved along the continuum towards richer statistical practices described by Eicher (2011)

Discussion Questions

- What role do large scale OPD models have in challenging educators' beliefs and perspectives about content and pedagogy?
- What are the challenges and affordances of designing and engaging educators in OPD?
- How could MOOCs be used along with f2f models or other online support for engagements?

Contact Information

Access Courses for FREE at

place.fi.ncsu.edu

Teaching Statistics Through Inferential Reasoning - Spring 2019 (Feb-May 2019)

Teaching Mathematics with Technology - Spring 2019 (Feb-May 2019)

https://hirise.fi.ncsu.edu