# Impacts of a Teaching Statistics MOOC on Educators' Perspectives and Practice

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# Introduction: Why Online Professional Development?

- Teachers often have limited experiences in statistics education (Burrill & Biehler, 2011) and are trained in programs that do not support becoming effective statistics teachers (Zieffler et al., 2018).
- Small, local PD programs are insufficient in supporting teachers' development of content and pedagogical knowledge at scale.
- Some PD models have moved online to take advantage of scale and affordances of the web (Dede & Eisenkraft, 2016).
- Free and open PD, such as MOOCs, can reach more teachers across geographic boundaries (Kim, 2015; Kleiman, Wolf, & Frye, 2015).

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# Changing Teaching Practices

- Beliefs and perspectives about statistics lead to different teaching practices.
  - teacher's ideas about the **nature of statistics**, about **oneself as a learner of statistics**, and about the **classroom context** and **goals for students' learning statistics** (Gal, Ginsburg, & Schau, 1997; Pierce & Chick, 2011; Eichler, 2011)
- PD should support moving teachers along a continuum from traditionalists towards a focus on investigative processes (Eichler, 2011).

# 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

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# Research Question

*How can participation in an online professional development course impact educators' perspectives about statistics and teaching statistics?*

*How do educators implement new ideas in their practice?*

# Participants

- 2526 educators enrolled from Fall 2015 - Fall 2017 (6 courses)
- 84 countries represented, with majority in the US (79%)
- Majority were female (66%)
- Most (75%) held an advanced degree and 21% had obtained a 4-year college degree
- 61% identified as classroom teachers
- Mean of 14 years of teaching experience

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# Analysis

- Descriptive statistics and graphical displays of registration and click data using Tableau
- Forum posts - identified Unit 5 posts by participants
    - Each post was a unit of analysis
    - Open-coded for changes in shifts in beliefs
- Themes of changes used to code all surveys for confirming/disconfirming evidence

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# Results

- Participation trends
- Impacts on beliefs and perspectives about statistics and teaching statistics
- Implementation of new ideas in practice

# How do participants engage across units?



TSDI Participation by Units
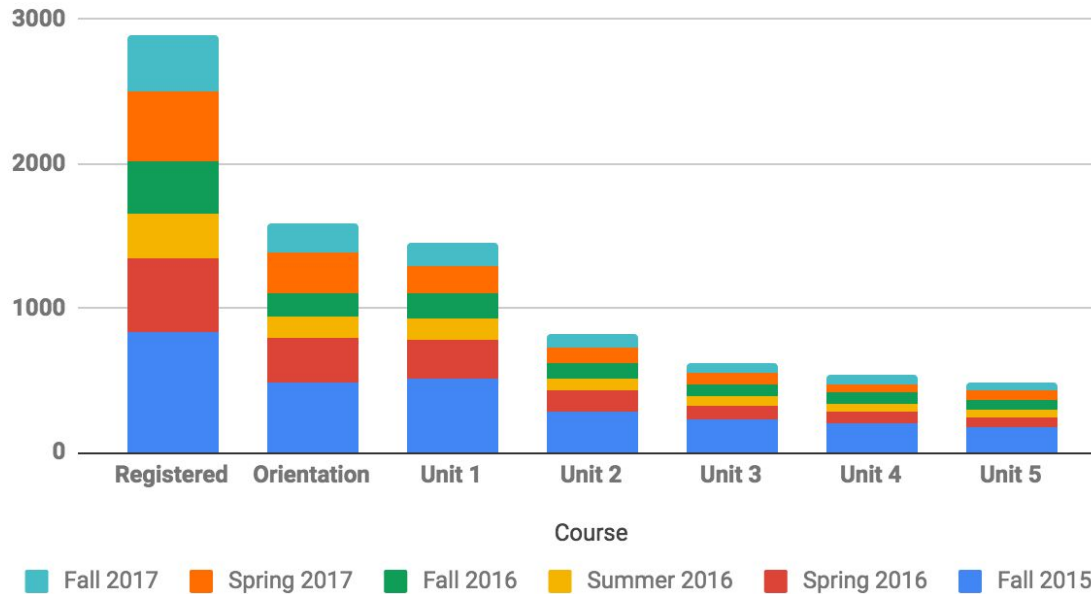
| Course | % completed who accessed Orientation | % completed who accessed Unit 1 |
|---|---|---|
| Fall 2015 | 20 | 37 |
| Spring 2016 | 21 | 38 |
| Summer 2016 | 35 | 34 |
| Fall 2016 | 46 | 44 |
| Spring 2017 | 20 | 28 |
| Fall 2017 | 30 | 39 |
| *All courses* | **31** | **33** |

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# How do participants engage with materials/resources?

| Unit | % participated who accessed Orientation |
|------|------------------------------------------|
| Unit 1 | 92 |
| Unit 2 | 52 |
| Unit 3 | 39 |
| Unit 4 | 34 |
| Unit 5 | 31 |

- 1744 (69%) accessed course materials/resources
- 1552 (61%) who registered engaged in Orientation Unit
- 2565 total discussion forum threads
- 6386 total posts
- 6.65 posts per participants

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# Impact on Perspectives about Statistics and Teaching Statistics: Major Themes that Emerged

- Statistical thinking involves **different processes** than mathematical thinking.

- Engaging in statistics should involve **exploring data.**

- **Posing good statistical questions** and selecting a **context** that is interesting/relevant to students is important in engaging students in statistical thinking.

- Engaging in statistics is **more than computations** and procedures and should **include investigative cycles and habits of mind.**

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# Impact on Perspectives about Statistics and Teaching Statistics: Major Themes that Emerged

- Engaging in statistics is enhanced by the use of **dynamic technology**.

- Engaging in statistics requires **real (and messy) data**.

- Statistical thinking **develops along a continuum**.

- Teachers **do not have to know all answers** when engaging students in the investigative cycle.

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**Examples: Engaging in statistics is more than computations/procedures and should include investigative cycles and habits of mind.**

*"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*

*"**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*

# Implementation of New Ideas in Practice

- Participants reported implementing or planning to implement course resources (e.g., Census at School, Gapminder) and dynamic software/technology (e.g., StatCrunch, Tuva, CODAP)

- 84% indicated they acquired knowledge and skills
  - 63% signified they had applied this in their practice, while only 45% reported that newly acquired knowledge/skills had an impact on student learning

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# Examples: Implementing New Ideas in Practice

*"more **interactive data explorations** in class (having gained the confidence to try them instead of lecturing material as students)" -Fall 16 Participant*

*"trying to use **more data that the students can relate to** and is **more real-world applications** and not just problems from a book" -Fall 16 Participant*

*changed practice with "**integration of technology** definitely. I was exposed to some really good tools" -Spring 16 Participant*

*"used the **resources** and **framework for choosing and developing tasks**" in planning her lessons -Summer 2016 Participant*

# Discussion

- What role do OPD models have in challenging educators' beliefs and perspectives about statistics and teaching statistics?
- What are the challenges and affordances of designing and engaging statistics educators in OPD using these types of models?

# Acknowledgements

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Access Courses for FREE at
## place.fi.ncsu.edu

**Teaching Statistics Through Data Investigations -  Fall 2018 (Sept-Dec 2018)**

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

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