DESIGNING FOR EDUCATORS IN A TEACHING STATISTICS MOOC: DESIGN PRINCIPLES, USE OF MULTIMEDIA, PARTICIPANT ENGAGEMENT AND REFLECTION

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Why Statistics Professional Development Online?

- Local, small scale PD is insufficient for demand in many countries.
- Some design online PD to reach a specific geographic region.
- Online communities provide members with “extended access to resources and expertise beyond the immediate school environment” (p. 11, Mackey & Evans, 2011).
- Free and open PD as MOOCs can reach more teachers across geographic boundaries (Kim, 2015; Kleiman, Wolf, & Frye, 2015).
Example Online Efforts

MOOCs for all for improving statistics knowledge

• Chris Wild at University of Auckland in NZ (www.futurelearn.com/courses/data-to-insight),

Online Professional Development designed for teachers to improve skills for teaching statistics

• Rolf Biehler and colleagues at German Center for Mathematics Teacher Education
• Dalene Stangl at Duke University in US offered statistics course for teachers through Coursera

*Teaching Statistics Through Data Investigations* MOOC for Educators offered to educators worldwide at the Friday Institute at NC State, US.
Designing for Online Learning

• Multimedia design of graphics, diagrams, and animations should minimize cognitive demand and increase associations between images and explanations. (Mayer & Moreno, 2003)
• Factors that impacted positive engagement in MOOCs (Hew, 2016):
  a. problem-centric learning with clear expositions,
  b. instructor accessibility and passion,
  c. active learning experiences,
  d. opportunities for peer interaction, and
  e. using helpful course resources.
Designing Video for Online Learning

From Guo, Kim, and Rubin (2014):
• shorter videos
• intersperse an instructor talking with slides showing content
• speak at a faster rate with enthusiasm

From Lasaar & Toloza (2017)
• animated videos using stop-action animation tools
• overlaying animated figures over slides can create engaging videos.
Design of Online PD to Support Change

- Online PD that addresses varied needs and abilities of participants can be effective in changing teachers’ instructional practice (e.g., Renninger et al., 2011; Yang & Liu, 2004).
- Activities should be meaningful, accessible and relevant so participants can apply learning to their educational context (Ginsburg, Gray, & Levin, 2004; Vrasidas & Zembylas, 2004).
- Asynchronous discussion forums allow participants to reflect on practice, exchange ideas, and discuss ways to improve on their own schedules with colleagues with whom they may not otherwise interact (Treacy, Kleiman, & Peterson, 2002).
MOOC-Ed: Massive Open Online Courses for Educators

- Teaching Foundational Reading Skills
- Teaching Statistics Through Data Investigations
- Teaching Statistics Through Inferential Reasoning
- Computational Thinking and Design
- Learning Differences
- Supporting Learning Differences in Post-Secondary Environments
- Coaching Digital Learning
- Fraction Foundations
- Teaching Mathematics with Technology
- Disciplinary Literacy for Deeper Learning
- Leading the Digital Learning Transition

THE WILLIAM & IDA FRIDAY INSTITUTE FOR EDUCATIONAL INNOVATION
Teaching Statistics Through Data Investigations

gogo.ncsu.edu/tsdi

• First launched Spring 2015 with 789 enrolled
• FREE--funded by by Hewlett Foundation
• Designed for teachers -- focus on pedagogy
• Goal is to equip teachers with tools, frameworks, resources, and skills to teach statistics as an investigative process with real data
Design of MOOC-Eds

• Offered through custom platform

• Design Principles (Kleiman, Wolf, & Frye, 2015)
  – Self-directed Learning
  – Learning from Multiple Voices
  – Peer-supported Learning
  – Job-connected Learning
Examples of Self-directed Learning

• Differentiated activities, with personalized options
  – Consider tasks & students’ work across levels
  – Assessment items from LOCUS
  – Self-confidence survey (Self Efficacy for Teaching Stats)
• Units opened weekly but remained opened
• Course open for extended time (14 weeks) and participants always have access afterwards.
Examples of Job Connected Learning

- Read, analyze, and discuss tasks
- Watch, reflect, and discuss student and teacher videos
- Dive into Data tasks using free open tools (TUVA, CODAP)
- Introduction to, and engagement with, a major online source of data used in schools--Census at School
- Lesson plans and websites to use directly in classroom
Examples of Multiple Voices and Peer Support

- Instructor videos and brief papers
- Open resources written by others
- Expert panel videos
- Classroom videos
- Animated videos of students’ work
- Discussion forums
  - Participant voices
  - Exchange of ideas on various topics (e.g., task design; pedagogical approaches)
Framework Developed from Research-based Recommendations for Teaching

- GAISE Framework on statistical thinking (Franklin et al., 2007; Garfield et al., 2007)
- Research on students’ learning in statistics
- Developed new framework for supporting Students’ Approaches to Statistical Investigations (SASI)
  - Investigative cycle
  - Productive habits of mind
  - Levels of sophistication
Multimedia Learning Opportunities About SASI Framework

Brief Paper

Instructor Video with Explanations and Examples of Students’ Reasoning

Clickable Diagram

Table with Explanations
Other Video to Support Learning SASI

Expert panel discussion

Two expert interviews with Chris Franklin

Two animated videos of students’ work on a task that can be approached at different levels in SASI
Research

How do participants engage?

- Data click logs

What impact do designed aspects of course have on educators’ learning?

- Discussion forums in Unit 3
- End of course survey
Unit Participation Across Six Sections

Some skipped orientation and went straight to Unit 1, others came to orientation and did nothing else.

★ 33% of those who accessed Unit 1 made it to Unit 5!

2526 unique registrants
1744 enrollees (69%) showed up!
Discussion Forums

11 Forums: Introduction, and 2 per unit
- Discussion about course material
- User-driven discussion about issues in teaching statistics

Across the six sections, 959 participants posted at least once.
- 2,164 discussion threads containing 6,381 posts
- Mean of 6.65 posts per forum participant, with a skewed distribution since some participants posted 30-50 times within a course.
Better than Average Participation

69% show up rate of unique registrants across courses versus

- Median of 46% show up rate across 13 MOOCs (Perna et al., 2014)
- Mean of 50% show up rate across 59 MOOCs (Jordan, 2015)

33% completion rate vs median completion rate of 18% (range of 13-39%) across 13 MOOCs (Perna et al. 2014)
Impact of different multimedia on teachers’ learning

- “I like the SASI handouts [Describing the SASI framework] and graphs [diagram in PDF and interactive diagram]. I realized I do little on posing questions and data collection. I spend most of the semester on analyze and interpret. I have the framework posted right next to my desk now. I think about how to modify how I teach everyday.”

- “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.”
Impact of different multimedia on 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.”
“What was the most valuable aspect of this course?”

From end-of-course survey in Unit 5, most commonly referred to learning experiences in decreasing frequency:

• Access to resources, technology tools, websites, and lesson plans
• Learning from videos of expert panel discussions
• Learning from videos of students and teachers work in classrooms
• Introduction to the SASI Framework
• Focus on improving questioning, exploration, engaging students, and active learning
• Engaging in discussions with colleagues
• Appreciation for flexibility and learning at own pace
• Being grateful for opportunity and inspired to learn more
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Self-directed learning

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Learning from multiple voices

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Peer-supported learning

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- **Engaging in discussions with colleagues**
- Appreciation for flexibility and learning at own pace
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Conclusions

• Design principles and multimedia designs created memorable learning opportunities that can shift perspectives and potentially teaching practice
• Expert panel discussions and interview videos highly impactful on perspectives about statistics & curriculum
• Real and animated videos of students’ work help teachers apply learning to practice and envision classroom possibilities
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Free access to courses
place.fi.ncsu.edu
Teaching Statistics Through Data Investigations  Sept-Dec 2018
Teaching Statistics Through Inferential Reasoning  Feb-May 2019