

Online Learning Experiences and Impact on Statistics Education Perspectives

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Background

- Importance of developing statistically literate students in a data-driven world (Kwasny, 2015)
- American Statistical Association guidelines for
 - K-12 students' learning (Franklin et al., 2007)
 - Mathematics teacher preparation in statistics (Franklin et al., 2015)
- However, many preservice mathematics teachers are not well-prepared to teach statistics (Lovett & Lee, 2017)

Research Question

When teachers engage in online modules, what perspectives about teaching and learning statistics do they express, and later enact, in planning to teach statistics?

Review of Literature

- Teachers of statistics enter classroom with already-developed **perspectives** of statistics education based on
 - Previous experiences as learners of statistics, in and out of school, or
 - Belief that statistics and mathematics are the same (Gal, Ginsburg, & Schau, 1997)
- **Using technology to teach and learn statistics** allows teachers to
 - create data visualizations to aid in analysis
 - link multiple representations, and
 - augment graphs with statistical measures (Lee et al., 2014)
- **Online teacher preparation** can be effective with
 - a supportive learning environment
 - higher levels of motivation of learners
 - contexts that encourage instructor and peer interaction, and
 - opportunities to practice material (Noesgaard & Ørngreen, 2015)

Review of Literature

- **Related study** investigated experiences in an online professional development course (Lee, Lovett and Mojica, 2017)
- Impacted participants' **perspectives about statistics teaching** related to:
 - 1) statistics being more than computations and procedures,
 - 2) using dynamic technology,
 - 3) using real, messy data, and
 - 4) increasing students' levels of statistical understanding.

Methods

- **Participants:** Eight preservice (PST, 4 undergraduate, 4 graduate) and three inservice teachers (IST, graduate-level)
- **Context:** Online (mostly asynchronous) Teaching Mathematics with Technology class at a large Southeastern university
- **Data:** Four discussion forums in the first two modules (of 6) on teaching statistics with technology and statistics, and nine lesson plans (some worked in pairs) on teaching a topic in statistics participants submitted after all six modules.
- **Analysis:**
 - Discussion Forums
 - Data-driven category codes (also informed by literature) and subcodes
 - Lesson Plans
 - Coded using subcodes from forum analysis
 - Frequencies calculated and trends identified

A learning module

ESTEEM 1.2 Supporting students' statistical investigations

In this module you will learn about a framework that can guide you in supporting students' statistical reasoning, including designing tasks and making sense of students' work. You will also continue the Roller Coaster investigation with a larger dataset. Time expectation: 9-10 hours

Read & Watch

Essential Materials

- 1.2.a. Supports for Learning to Do Statistical Investigations
- 1.2.b. A Guiding Framework for Teaching Statistics
- 1.2.c. Tasks as Opportunities for Statistical Learning
- 1.2.d. Read & Watch quiz
Mar 29 | 8 pts

Learn From Practice

- 1.2.e. Expert Teacher Interview on Tools & Resources
- 1.2.f. Teaching Statistics Using Multiple Technologies

Engage with Data

- 1.2.g. Investigating More Roller Coasters
Mar 30 | 30 pts
- 1.2.g2. More Roller Coasters Investigation Screencast
Apr 5 | 30 pts
- 1.2.h. Examining Students' Work on the Roller Coaster Task
Apr 5 | 10 pts

Synthesize and Apply

- 1.2.i. Supporting Statistical Discourse with the Roller Coaster Task
Apr 12 | 80 pts
- 1.2.j. Analyze Tasks and Discuss
Apr 5 | 20 pts

Web-based Reading and Videos

Instructor-Led Video

Reading & Expert Panel Video

Video of Expert Teacher Panel

Classroom Video

CODAP Investigations

Video of Students Using CODAP & Discussion Board

Classroom Video & Reflection Paper

Discussion Board



Results

Five salient areas of participants' perspectives emerged:

- the nature of statistics
- features of a good statistical task
- learning statistics
- the practice of teaching statistics
- role of technology in statistics education

The Nature of Statistics

- Statistics is different than mathematics:
 - “Statistical thinking is very different from “standard” math thinking. “Standard” math involves a lot of procedural thinking and there is always some form of right answer. In statistics, procedure is important, but context, interpretation, and analysis is heavily involved in the process.” (PST, undergraduate student)
- Statistics is engaging and fun for students.

Features of a Good Statistical Task

- Interactive or “hands-on”
- Data should be interesting to students, real, and relatively large
- Involves at least one phase of the statistical cycle (pose→collect→analyze→interpret), with many wanting all four parts

Learning Statistics

- Time for students to get acquainted with data first
 - “[In this video], connecting students with the data before they start analyzing was emphasized. This means allowing students to know what was going on when and where the data was taken.[...]Knowing about the data before I started working with it allowed me to adequately analyze and learn more about statistics. I did not use this method while I was learning statistics in high school, but I do plan on using it when teaching statistics.”
- Technology can affect how a student interacts with a statistical task
- Diversity of students’ statistical skill levels and need for teachers to address this diversity

The Practice of Teaching Statistics

- Teachers need to ask good questions:
 - “I am also concerned about being able to effectively direct my students with the right questions so that the task is successful. [...] If I am not able to direct the task effectively we would not reach our outcome goals or be able to help the students develop along the statistical thinking chart.”
- Ensure students are engaged
- Grouping students can be beneficial

Role of Technology in Statistics Education

Impact on statistical learning:

- Quick graphical displays and calculations and multiple linked representations makes data easier to analyze and interpret.
- Ease of use impacts how much a student learns
- Statistical technology tools would be difficult for students to use

Methods for implementing:

- Students would need adequate time to learn the technology
- Guidance needed from teacher on use of technology
- Different tools appropriate for different age or statistical skill levels
- Correct choice of tool depends on the task or learning objective

Comparing Discussion Posts with Lesson Plans

Oftentimes, perspectives that participants expressed in discussion forums were also reflected in their lesson plans:

- All planned tasks were hands-on and interactive
- Most lesson plans had tasks with students analyzing and interpreting data
- All tasks used real data, most used data likely to be interesting to students, and most used large data sets
- Most lesson plans included a launch phase or activities intended to get students engaged in the content of the lesson.

Comparing Discussion Posts with Lesson Plans

Several perspectives popularly expressed in discussion posts, but *rarely* appearing in lesson plans:

- students posing their own statistical questions to investigate
- students collecting their own data
- students needing guidance on how to use technology

Discussion

- Given that participants were typically not expressly asked about their perspectives, they may have perspectives that they didn't express.
 - E.g., only 3 expressed that students should be grouped, yet all participants included grouping of students in their lesson plan.
- Were perspectives due to experiences in the module or outside experiences?
- Why the discrepancies between what participants said (discussion forums) and what they enacted (lesson plans)?

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Thanks!
Any questions or
comments?