

# Primarily Statistics: Developing an Introductory Statistics Course for Pre-Service Elementary Teachers

Jennifer Green and Erin Blankenship

Montana State University and University Of Nebraska – Lincoln

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[jgreen@montana.edu](mailto:jgreen@montana.edu) [erin.blankenship@unl.edu](mailto:erin.blankenship@unl.edu)

# Outline

- Motivation
- CATALST Project
- The Course
- Assessments
- Challenges

## Motivation/Goals

- “Statistics is the science of data, and the daily display of data by the media notwithstanding, most elementary teachers have little or no experience in this vitally important field” (pg 87, MET Report, 2001)
- Post-GAISE introductory course: creates statistically literate citizens, does not necessarily develop statistical content knowledge for teaching
- Create a course that integrates content, pedagogy and assessment issues
- Develop an appreciation of statistics as a discipline separate from mathematics; connections to multiple subjects
- Focus on K-8 statistics standards (Nebraska, NCTM, Common Core)

# The CATALST Project

- NSF-funded project at the University of Minnesota
- Goal: Immerse students in statistical thinking
- Uses randomization methods to reinforce the concept of natural variability
- Fit well with our course goals, and consistent with the MET Report emphasizing the importance of developing the habits of a mathematical/statistical thinker
- Collaborated with the CATALST group to adapt activities for use with pre-service teachers

# The Course: Logistics

- Special section of general intro course; enrollment was controlled
- Co-taught by 2 faculty members
- 26 students; 65% first-semester freshmen
- No lectures; all class sessions based around activities or discussion

# The Course: Outline

- 1** Chance Models and Simulation (CATALST)
  - investigate differences between theoretical and empirical probability
  - inference via simulated p-values
- 2** Data Summary
  - translate knowledge about graphical and numerical summaries into classroom practice
- 3** Models for Comparing Groups (CATALST)
  - inference via simulated p-values (randomization tests)
  - connections to elementary classroom

# Informal Assessments

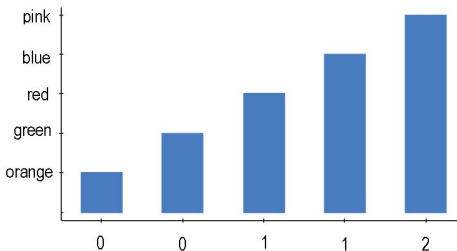
## Journals

- Reflections on Readings
  - NCTM Yearbook: *Thinking and Reasoning with Data and Chance*
  - classroom discussions
- Reflect on Activity/Understanding
  - “What is your definition of random and why? How would you define random to a 2nd grader? A 6th grader?”
  - “How has your opinion about the relationship between mathematics and statistics changed over the course of the semester?”

# Formal Assessments

## Exams

- Two exams during the semester; one after each of the first two units
- Included both traditional, calculation-based problems and conceptual problems focusing on pedagogy
  - Example: What is your favorite color?





# Formal Assessments

## Exams—Another Example

Two students (Max and Amber) take turns rolling a 6-sided die and get the following results:

Roll #	1	2	3	4	5
Max	6	6	6	6	6
Amber	1	3	4	3	2

After his fifth roll, Max complains that the game is not fair, because he has lost his turn five times in a row. The other student (Amber) argues that Max's sequence of rolls is just as likely as her sequence of rolls, and he should quit complaining. You (the teacher) must settle the argument between Max and Amber. Who do you agree with? Carefully explain why.

# Formal Assessments

## Exams—Sample Responses

- “I would agree with Amber. I would agree with her because she is right, Max’s sequence of rolls is just as likely as her sequence of rolls. They both have a 6-sided die with the same numbers on it, so they both have a  $1/6$  chance of getting a 6, Max just happens to get it every time.”
- “... to have as many 6s in a row as Max did is a lot rarer than Amber’s rolls which had a wider variety of numbers. I don’t think you can side with one over the other.”
- “I agree with Amber because you’d have to explain that the number you roll is based on a random chance (random meaning no specific order).”

# Formal Assessments

## Lesson Plans

- Three over the course of the semester; one for each of units 1 (probability) and 2 (data summary); final project of the group's choosing
- Must address chosen standard(s) and be appropriate for grade level
- Peer-reviewed, instructor-reviewed with chance for revision before grading; peer review/grading rubrics are in Appendices

# Challenges

- 65% first-semester freshmen!
  - little/no experience with classrooms
  - thinking like a student  $\Rightarrow$  thinking like a novice teacher
- Balancing statistical content and content knowledge for teaching
  - articles/reflections/lesson plans helped them connect the two
- Creating authentic exams

# Thank You!

Questions/Comments/Suggestions?