MASTERY-BASED GRADING AT SCALE IN GE STATISTICS

Introducing students (and instructors) to Mastery-Based Grading using rubrics

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TODAY'S ENVIRONMENT

- EO 1110 Implementation
- Statistics at Scale
- Lack of Preparation
- Need for coordination and consistency due to scale of implementation
- What does an "A" mean? What does "passing" mean?

TRADITIONAL GRADING SYSTEMS – WHY CHANGE?

- Student learning outcomes at the course level
  - How to assess them?
- Hunting for Partial Credit
- Who has the responsibility for a grade?

WHAT IS MASTERY-BASED GRADING?

- Clear Standards relating course content to SLOs
- Student grades dependent on quantity of material mastery at a sufficient level
- Opportunities to demonstrate mastery throughout the semester
- Material not related to demonstrating mastery is not assessed for final grading

MASTERY-BASED GRADING(MBG) THE STANDARDS

- Developed specific standards that tie course content directly to student learning outcomes
- Sample Descriptive Statistics Standards;
  - D3: Describe, use and identify different types of statistical studies, including observational study, experiment, census, and sample survey.
  - D4: Critique and modify the design of statistical studies, including finding and repairing flaws in the study design and data collection methodologies, such as issues of confounding and blinding.
- Sample Communications and Reasoning Standard:
  - CR3: Use both graphical and numerical summary statistics to draw conclusions about a data set or to compare different data sets. Properly use sample statistics to draw conclusions about the population, recognizing any underlying assumptions or limits of the analysis.

EXAMPLE - ASSESSING CONTENT

Researchers are interested in evaluating the effectiveness of fertilizer and irrigation on poplar tree health. Fertilizer is used with one group of 75 poplar trees in a sunny region, and irrigation is used with 51 poplar trees in a cloudy region. The researchers doing the measurements of tree health are aware of which trees receive fertilizer and which trees receive irrigation.

a) Is this an experiment or an observational study? Explain why.
b) Identify any problems with the design that are likely to cause confounding and explain how the problems could be avoided.

MASTERY-BASED GRADING – COURSE GRADE

- Assessment of mastery in three rubric graded assignments
- Levels of mastery:
  - Exceeds Mastery, Meets Mastery, Near Mastery, Well Below Mastery, Not Assessable
- Digital badges for low-stakes participation assignments and attendance

Overall Course grade

Desired grade	Descriptive Statistics standards	Inferential Statistics standards	Communication standards	Badges (to be described later)
A	**M or better** on all	M or better on all	M or better on all	Attendance badge & **GOLD** participation badge
	E on at least 10 of the 20 standards (in any combination)			
B	M or better on 8 of the standards and at least N on the other two	M or better on 8 of the standards and at least N on the other two	M or better on all	Attendance badge & **SILVER** participation badge
C	M or better on 7 of the standards	M or better on 7 of the standards	N or better on all	Attendance badge & **BASIC** participation badge

REASSESSMENT TO ALLOW FOR DEMONSTRATION OF MASTERY

- Each statistics standard is assessed in three major assignments: in-class lab, project, and midterm
- One assessment trio for descriptive and one for inferential statistics
- Reassessment:
  - Fall 2018: final exam
  - Spring 2019: resubmission of assessments, retesting, final exam

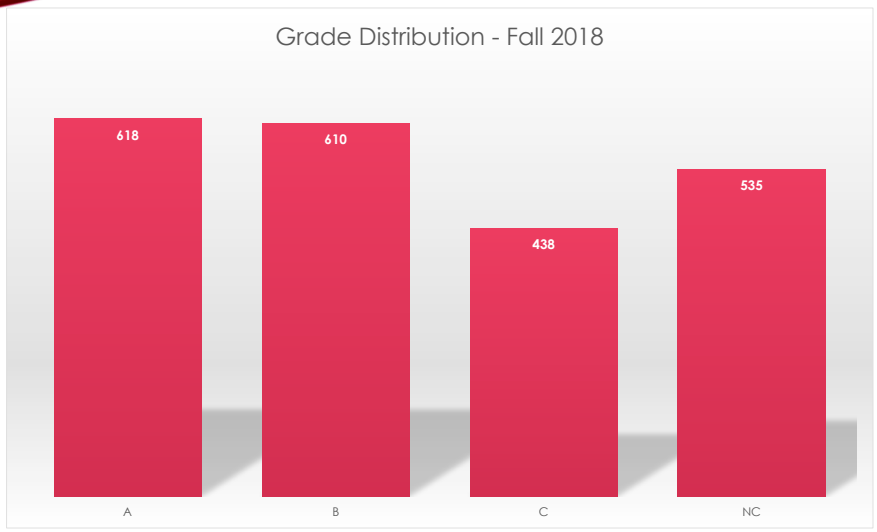
SUMMARY

Mastery-Based Grading:

- Reduces scheming and grade grubbing
- Places the responsibility on students for their grades
- Provides assessments that are more forgiving and track with studies in cognition
- Increases metacognition and self-awareness in students

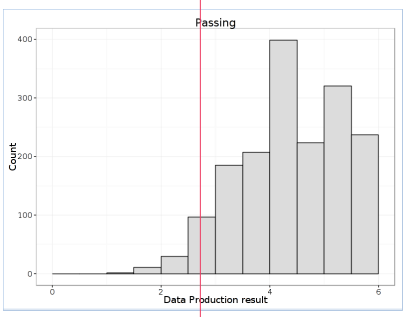
FALL 2018 STANDARDS & RESULTS

- 3 broad standards – Data production, Data Analysis, and Inferential Statistics
- Each assessed with three assignments
- Mastery score from 1 – 6:
  - 6 – Exceeds Mastery
  - 4 – Meets Mastery
  - 2 – Near Mastery
  - 1 – Well Below Mastery
- To Pass, students needed to on average, obtain a mastery score of 2.7 on all three standards.

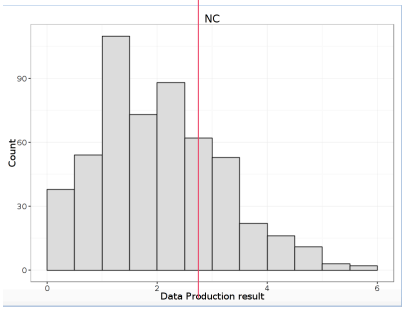


FALL 2018 RESULTS

Data Production Mastery Score for Students who Passed

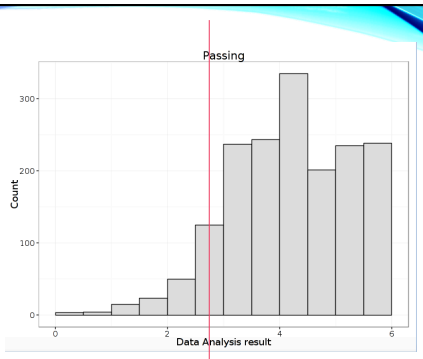


Data Production Mastery Score for Students who did not pass

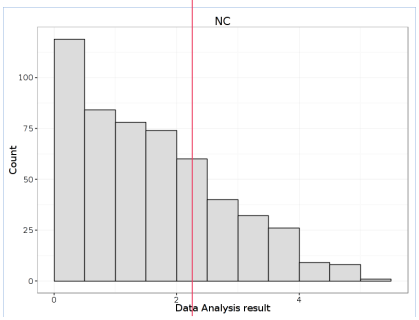


FALL 2018 RESULTS

Data Analysis Mastery Score for Students who Passed

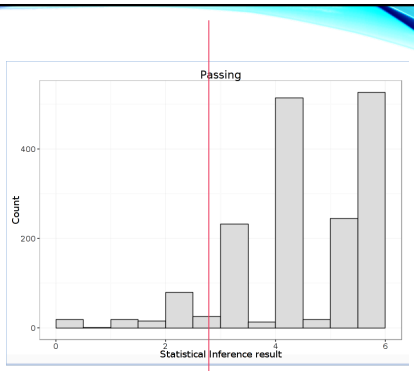


Data Analysis Mastery Score for Students who did not pass

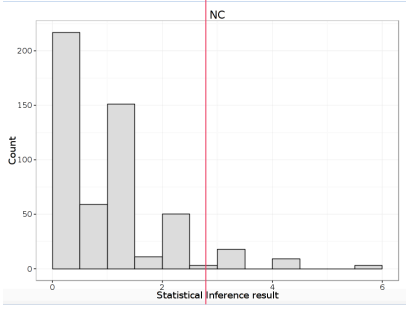


FALL 2018 RESULTS

Statistical Inference Mastery Score for Students who Passed



Statistical Inference Mastery Score for Students who did not pass



WHAT WORKED AND WHAT DIDN'T

FALL 2018

- *Instructors were cautiously supportive but unclear & not convinced*
- *Students were confused*
- *Initial three standards were too broad & vague*
- **Overall pass rates increased from previous years**
- **Increased focus on higher level thinking (analyze, model, create, critique)**
- **Student Empowerment**
- **Growth Mindset focused – opportunities to Fail Forward**

SPRING 2019

- Instructors are very supportive of new, more detailed standards & of MBG in general
- 24 total standards – additional detail & clarity, opportunity for consistent grading w/ maintained focus on higher level thinking
- Student feedback incorporated into design of new standards
- Videos explaining the grading system added to LMS
- Increased student empowerment through additional retesting/resubmission