Preserving Student Intuition on In-Class Examples

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Context

- Goals of in-class examples:
  - Teach appropriate communication/writing style
  - Demonstrate techniques
  - Students can generalize procedures, tools, and writing to new problems
- Problems:
  - Often only showcase one solution, writing style, or thought process.
  - Student misconceptions are not always rectified by seeing correct examples.
  - Especially in "partial credit" courses, students can earn good grades for incomplete learning.
  - Students are passive "receivers" of knowledge, vs active "possessors" of knowledge.

Teaching Intervention

- For each in-class example, students are required to spend 3-7 minutes attempting the problem on their own, with varying levels of pre-instruction.
- Afterwards, the instructor presents (or solicits) a "correct" solution. Students are required to preserve both solutions.
- Students are asked to match in-class examples to homework problems and reflect on whether it was helpful to have both their initial attempt and the given solution.
- Beginning, mid and end of semester surveys used in 3 courses:
  - 300-level Probability (Fall 23, 8 participants),
  - 300-level Abstract Math (Spring 24, 8 participants),
  - 100-level Contemporary Math (Spring 24, 14 participants).

Research Questions

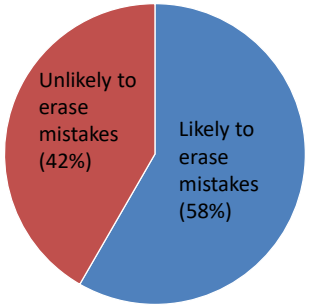
- Do students see value in their initial attempts at problems, even if they are wrong?
- Does preserving student intuition improve their experience?
- Does the double-entry journal method for examples improve student utilization of in-class examples?
- Can the double entry example method help validate students' own communication methods?

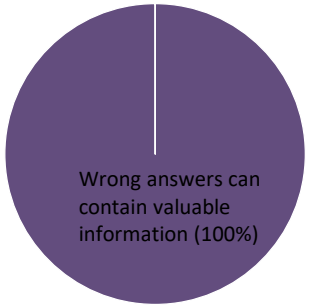
Class Notes as a Resource

First Attempt Vs Given Solution

First attempt goals:	Given Solution goals:
• Highlight student intuition • Allow students to communicate in their own way • Allow student misconceptions to shine through	• Model appropriate mathematical writing • Showcase an appropriate level of detail and rigor • Give sufficient detail to allow students to compare their solutions for accuracy.

Student behavior vs understanding





Preserving First Attempts as a Learning Tool

- Students reported using the double-entry journals as study tools for help on homework problems.
  - "I could see where I went wrong"
  - "I could avoid repeating mistakes"
- 100% of Probability students reported thinking the double-entry method (specifically with time allocated in class for first attempts) was helpful and would be helpful in other classes
- Linking examples to their homework problems proved useful to them and to me as an intervention tool.
- Students need a LOT more time to meaningfully complete examples.

Preserving First Attempts to Promote Equity

- Using initial attempts as a learning tool lends to an asset-based mindset.
  - "My solution doesn't look the same, it must be wrong" vs "My solution contains a lot of the same components as the instructors, only the notation is different"
- Allowing time for completing examples during class time is a type of active learning. We know active learning reduces achievement gaps in STEM.
  - (Theobald et al., *Active learning narrows achievement gaps for underrepresented students in undergraduate science, technology, engineering, and math)*
- In future iterations, I'll add assessing and correcting first attempts as a homework assignment.
  - Correcting problems allows students to be experts and validates their knowledge (Seda & Brown, *Choosing to See: A framework for Equity in the Math Classroom, 2021)*

Reflections

- I want my classrooms to feel like places of supported growth, not just assessing competence. Instead of students being worried about what they "need to know" I want them to honestly assess what they do know and reflect on where it is successful and not successful for the task at hand.
- The double-entry example format is meant to demonstrate, for students, their own growth during the course. I want to encourage a growth mindset with evidence. They also hopefully teach students that trying to solve problems is valuable in and of itself, not only when the answers are "correct."
- During WTFS, I benefitted from the continued assessment and feedback of my teaching methods and project proposal. We did peer review of syllabi and our SCoTL abstracts. During these reviews, the things I do well were observed and I was exposed to areas where I can grow and improve (like double-entry examples!)
- Additionally, interacting with peers in other disciplines and learning from the ways they break the lecture-based classroom paradigm is a constant source of inspiration.