Investigating Mathematical Reading Comprehension

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Introduction & Context

We studied students' **Mathematical Reading Comprehension (MRC)** and **overall success** in a flipped, recently redesigned large math course.

MRC Research Question: *"Did our redesign (and subsequent improvements) increase students' success and MRC?"*

Course: MAT223, Linear Algebra I @ UTM
Period: F/W semesters, 2019-2022

Methods

Instruments:

1. **Perceptions of Learning Mathematics Instrument** (Code et al, 2016), adapted with MRC-focused questions.
2. **MRC Test** (Self-designed, course-independent)
3. **Assessment of MRC problems** on course assessments (21-22 only).

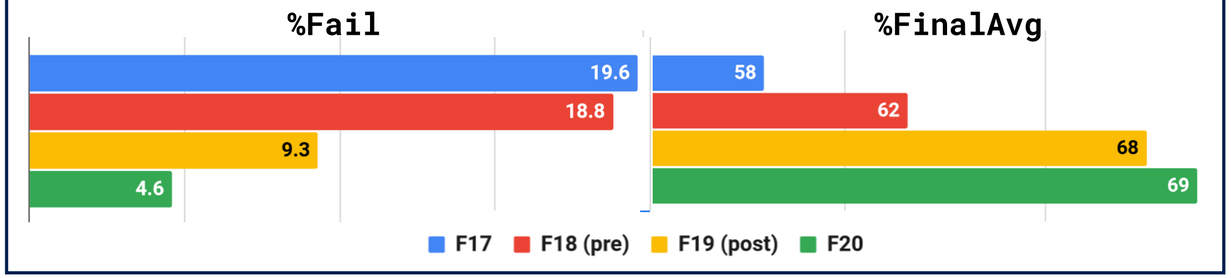
Delivery:

- **Instruments 1 & 2** were administered **Pre/Post-**semester online.
  (Course materials for all three years **targeted MRC** using 'scaffolded' pre-class readings and quizzes, and targeted instruction.)
- Students' performance on **MRC-focused problems (Instrument 3)** was compared early and late in the semester (in 21-22).

Results

Course redesign was successful (in line with literature, e.g. Freeman, et al 2014).

Figure 1: Grade Data for Pre/Post Redesign



Instrument 1 (Perceptions Survey)**:**

- Student responses showed self-assessed improvement in MRC (Figure 2).
- Overall changes in measures of confidence were similar to expected results (decreases, but by less than non-active courses).
- **ELL students** showed a statistically significant improvement in confidence reading mathematics pre-COVID (Figure 3).

Instrument 2 (MRC Test): no statistically significant change.

Instrument 3 (MRC Assessments)**:** students' performance showed no statistically significant improvement, and 1&2 were not improved during 21-22.

Figure 2: Self-Assessed MRC Improvement

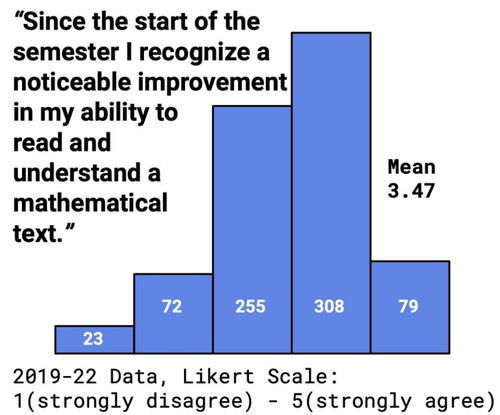
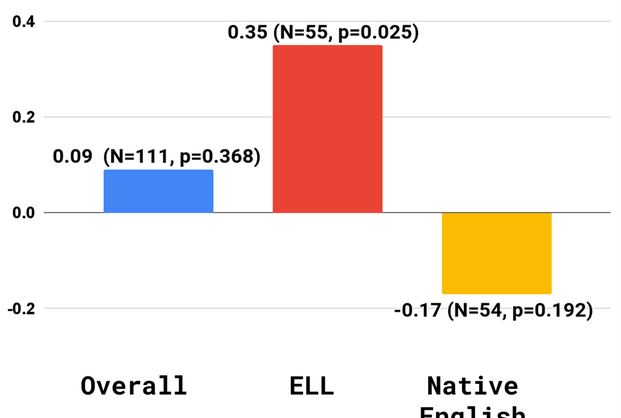


Figure 3: Average Pre/Post Change in Confidence



Discussion

- **Pre/post-COVID data** is hard to analyze**.**
- The timing and lack of incentives may have resulted in **unreliable MRC Exit Test data.**
- **MRC-focused assessments are taxing** (Directly assessing MRC increases the difficulty level of course assessments).

  Students performed worse in various measures in 21-22, including confidence.
- Very positive result (at least pre-COVID) suggests that **ELL students benefit from a focus on disciplinary reading** and that this can support equity/accessibility.
- **Improving and assessing MRC is hard!** Many of our instruments and methods could use significant refining.
- Unclear how students make use of "scaffolded" readings; a **qualitative tool** (e.g. focus groups), could help.

Code, W., et al (2016). The **Mathematics Attitudes and Perceptions Survey**: an instrument to assess expert-like views and dispositions among undergraduate mathematics students. International Journal of Mathematical Education in Science and Technology, 47(6), 917–937.

Freeman, S.., et al (2016). **Active learning increases student performance in science, engineering, and mathematics.** Proceedings of the National Academy of Sciences, , 111(23), 8410–8415.

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