“THROUGH IT ALL...I DID IT MY WAY”

What is the best way to teach...? 

Every teacher is unique. Some of us have impeccable recall, some are experts in applications while other revel in the more theoretical, some are incredibly organized, and others might deserve an off-Broadway production. Therefore, the way we teach should be unique and personal as well. Some lecture very effectively, some use inquiry-based learning, some show videos, some have class projects, some create applets or apps. But the common themes of what makes good teachers are engaging students to master learning objectives and inspire them to hunger for more learning.

“EVIDENCE-BASED”

What it is

- Applying the scientific method and using data to drive our decisions, actions, and policies
- Includes both quantitative and qualitative data
- Should be used in conjunction with non-quantifiables

What it’s not

- “Feel good” assessments
- Asking students if they liked the course
- Reporting on how evaluations went up
- Describing anecdotes from a small subset

SOTL IN MATHEMATICS

- A number of journals, including
  - The College Mathematics Journal (MAA)
  - Journal of Research in Mathematics Education (NCTM)
  - The Mathematics Educator
  - Journal of Computers in Math & Sci Teaching
  - Statistics Education Research Journal (IASE)
  - Journal of Statistics Education (ASA)
  - Technology Innovations in Statistics Education
- A number of universities have websites devoted to it
- James Fey (2007) gave a talk (“pitch”) at MAA’s Carriage House on SOTL in undergrad mathematics
- Often focuses on large, introductory classes

OUTLINE

- Scholarship of Teaching and Learning (SoTL) and Evidence-based Education
- Conducting Research in YOUR Classroom
- Examples from my research on SoTL

CONDUCTING RESEARCH

- What is the outcome of interest?
- Design
  - What are you comparing it to (control group)
  - Experimental vs. Observational
- Measurement
  - Use an existing instrument (ATMI, SATS)
  - Psychometrics - validity, reliability
- Unit of Randomization = Unit of Analysis
- Gain scores are sometimes inappropriate
- Recognize your own biases, how to overcome?
- Quantitative and qualitative results
- Get IRB approval
SMER REPORT


MY CLASSROOM-BASED RESEARCH

- Standards-based Grading
- The Importance of Student Attitudes
- Empowering Students, Improving Evaluations

VILLANOVA PARLO STUDY

- Proficiency-based Assessment and Reassessment of Learning Outcomes (PARLO)
  - Standards-based grading
  - Mastery learning
  - Competency-based grading
- Two sections of intro statistics (for non-majors)
  - Same instructor, same material
  - Back-to-back class times (1:30 / 3 pm on Mon & Wed)
  - Data gathered over two years (crossover design)
- Two groups
  - Control - Numeric grading
  - PARLO - Proficiency grading, Assignment resubmission
- Main Outcome – Common Final Exam
  - Additional Outcomes
  - Survey of Attitudes Towards Statistics
  - Course Evaluations

Results

- No differences on common final exam
- Students who resubmitted more did better
  - Not significant after controlling for aptitude
- PARLO students had better attitudes
- In PARLO class, students with delayed proficiency performed equally well on common final exam
- Student feedback was generally positive:
  - "You know what to expect each class"
  - "I like [his] method of grading"
  - "... an outstanding system"
  - "I had no idea where I stood on my grade"

THE PYRAMID OF RESEARCH

- Multistate/international, federally/corporately funded study with major, long-lasting impacts
  - Collaborators
  - Funding
  - Refinements

VILLANOVA PARLO STUDY

- Scatterplot of Final Exam vs. Delayed Proficiency
  - Mean=81
  - Mean=78
  - Mean=77
  - Delayed Proficiency (% of second time only)
PARLO STUDY (NSF-FUNDED)
- $2.4mil NSF-funded study over four years
  - 21st Century Partnership for STEM Education
  - Villanova University
- Randomized controlled trial of 44 high schools in the Greater Philadelphia Area
- Use PARLO in 9th grade algebra to improve student attitudes, engagement and achievement
- Professional development and ongoing learning communities for all teachers
- Software used/designed to facilitate tracking

OUTCOMES THAT MATTER
- We are measuring the wrong outcomes
  - Passing the class
  - Graduation from HS / Attending grad school
  - Did the students like the class
- Long-term retention!
  - Some research has shown that student attitudes are related to long term retention

VILLANOVA STUDY ON ATTITUDES
- Three research goals:
  - What is the impact of the first day on attitudes?
    - Randomized each student to pre/post first class
  - How are attitudes or changes in attitudes related to course performance?
  - How are attitudes or changes in attitudes related to long-term retention?
- All introductory statistics students at university
  - 868 students across 32 sections over two semesters
  - Gen Ed, STEM, Business, Nursing courses
- Survey of Attitudes Towards Statistics (SATS)

FIRST DAY IMPACT
- Affect (+0.25), Cognitive Competence (+0.22) and Difficulty (+0.34) were higher among those who took it after the first day
- There is large variability across professors
- If these results were applied to six published studies on student attitudes, conclusions would change for three (or four) of them
- Future - what contributes to changing student impact on the first day (qualitative study)

THE POWER OF CHOICE
- Will allowing students to allocate weight of several course components increase their interest and engagement?
  - Self-Assessment 15%
  - Case - Outline 10%
  - Participation 15-45%
  - Case - Write Up 15-45%
  - Class Project 15-45%
- Four MBA classes at two universities
  - Control and experimental groups
  - Crossover design to control for practice
- Results - students given choice
  - More satisfied with the course (+0.5)
  - More likely to take a similar course in the future (+0.8)
  - Didn’t perform any better/worse on course material
  - Didn’t accurately assign highest credit to their strengths

SUMMARY
- Evidence-based Evaluation of Your Teaching
  - What outcomes are important to you?
  - Is your study well-designed? (bias, confounders)
  - (later…) consider whether you can research this beyond the scope of your classroom
- SoTL is a way to synthesize research, teaching, and service
CAVEATS

- Pre-tenure folks: This talk focuses on teaching and SoTL. This type of research is not recognized by all universities on equal footing to theoretical innovations. Have a discussion with your mentors before you spend too much time on this.

RESEARCH

SERVICE

TEACHING

THANK YOU

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