

SUPPORTING GRADUATE STUDENTS

FOR SUCCESSFUL
TEACHING EXPERIENCES

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UNDERGRAD EXPERIENCE AS RELATED TO GRADUATE STUDENTS

- Part of delivering excellence for undergrad is supporting teachers so that they are well equipped to deliver high quality instruction.
- Graduate students at research universities often serve as GTAs and many as instructors of record in undergraduate courses.

FROM GRAD STUDENT TO INSTRUCTOR: WHY?

- Mathematicians in academia: part of profession
- Employed outside of academia? effective communication is key
- So: teaching is part of professional development for grads

GRAD STUDENTS AS PRIMARY INSTRUCTORS

- At research universities either calculus is taught in lecture or it is taught in small classes.
- If we value active learning and high quality mathematical classroom conversation, we might lean towards small classes taught by graduate students.
- We owe it to our undergraduates to require excellence in teaching.

CROSS-INSTITUTIONAL PERSPECTIVE

- **Half a century ago:**
 - Very minimal attention to supporting graduate students around teaching
 - Many places had non-optimal dept/dean rel'ns stemming from instruction issue.
- Gradually, support programs evolved independently

AGENDA:

- **Tale of two graduate teaching programs**
 - Harvard's Program: a tale of evolution
 - Duke's Program: a tale of current practice
- **CoMinDS: College Mathematics Instructor Development Source :**
 - An MAA Project
 - Originated in a conversation between Jack Bookman (Duke) and Robin Gottlieb (Harvard) in which we realized
 - That it might have been helpful to have conversed earlier!
 - That facilitating further conversation between our counterparts across universities would be helpful
 - That new programs could get tips from established programs

EVOLUTION ~ HARVARD

Parameters:

- Nearly all of our grads eventually teach their own section of calculus with 20-35 students. All must teach in some capacity.
- To teach in small classes we **need** grad student teachers. Most teach multiple times.
- 8-15 grads/year. Teach 2nd yr. on.

Students are admitted to our doctoral program for potential as research mathematicians ~

That has not always translated neatly into a department full of exceptional Teaching Fellows



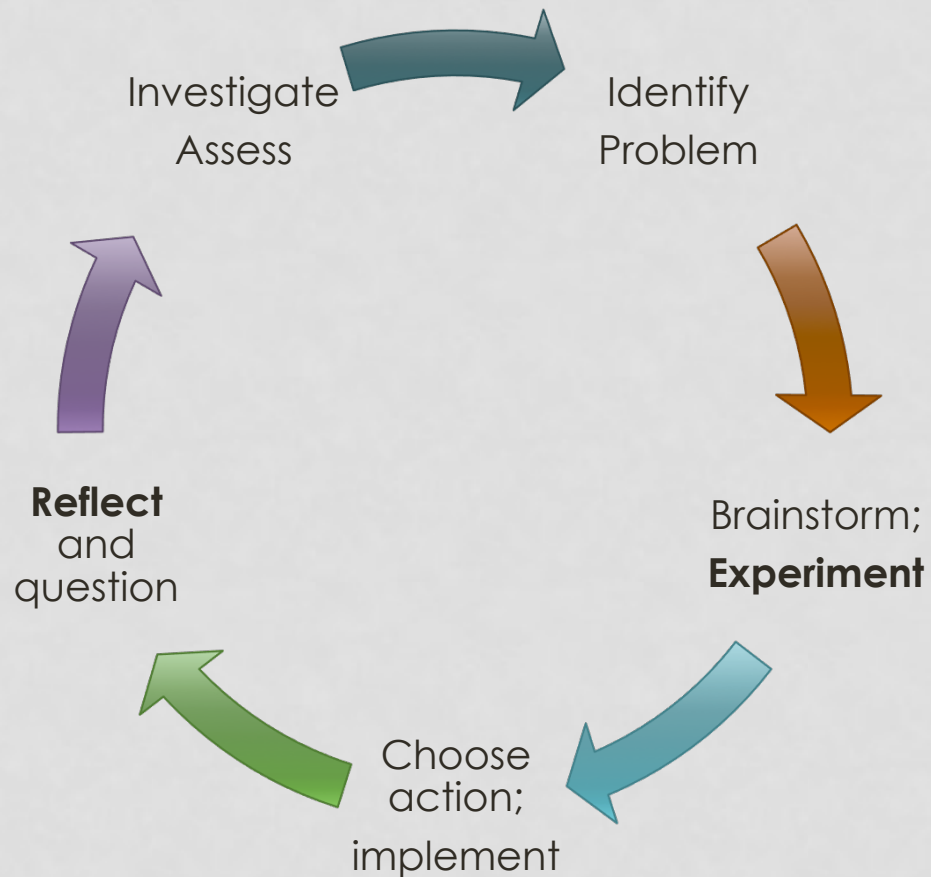
FROM BUSHWHACKING TO PATHWAYS

- Problems are great motivators for progress.
- Before 1982: No real rites of initiation.
 - Grad students assigned to courses, given text and told to report to duty.
- Quality of instruction: “uneven”
 - No surprise!
 - **Complaints:** from students, parents, deans . . .
- Mumford: Chair. Recognized problems.

SKILLS DESIRED

- Orchestrate a student-centered classroom
- Serve a diverse set of students
- Facilitate active learning
- Reflect on practice and continue to grow as an instructor

PROBLEMS DRIVE INNOVATION



LESSONS LEARNED EARLY

- Want **active learning** in classes? Show a model of active learning.
- Want **student-centered** classes? Teachers must know who their students are.
- Want to have a **successful** classroom? Reflect on what success means.
- Want to **change** the culture? Be deliberate.
- Want **inclusivity**? Make sure the sieve model is banished.

APPRENTICE PROGRAM

- **Guided observation** (model)
- **Work in Question Center** (learn about students)
- **Sequence of Three Lessons:**
 - First lesson: planned with coach, previewed with *calculus students*
 - Second lesson: videotaped, watched, feedback collected
 - Third lesson: more supervised experimentation

ONGOING STRUCTURAL SUPPORT

- Course coordination
 - **Weekly course meetings**
 - Look back and reflect
 - Look forward and plan
 - Use the experience of those who have taught before
 - What are common student misconceptions?
 - Write and grade exams together

PRE-SEMESTER SUPPORT

- **Calculus Team Meeting**
 - Build community around pedagogy
 - Who are our students; supporting all our students
 - Lessons learned: experienced grad students -> new (built in time to reflect)
 - What's great about teaching?
 - Logistical info/ Lesson planning exercise
 - Importance of first class
- **Team viewing of first classes**

BASIC SUPPORT

TF in his/her own Classroom

Pre-semester calculus orientation

Midterm feedback

Teaching observation

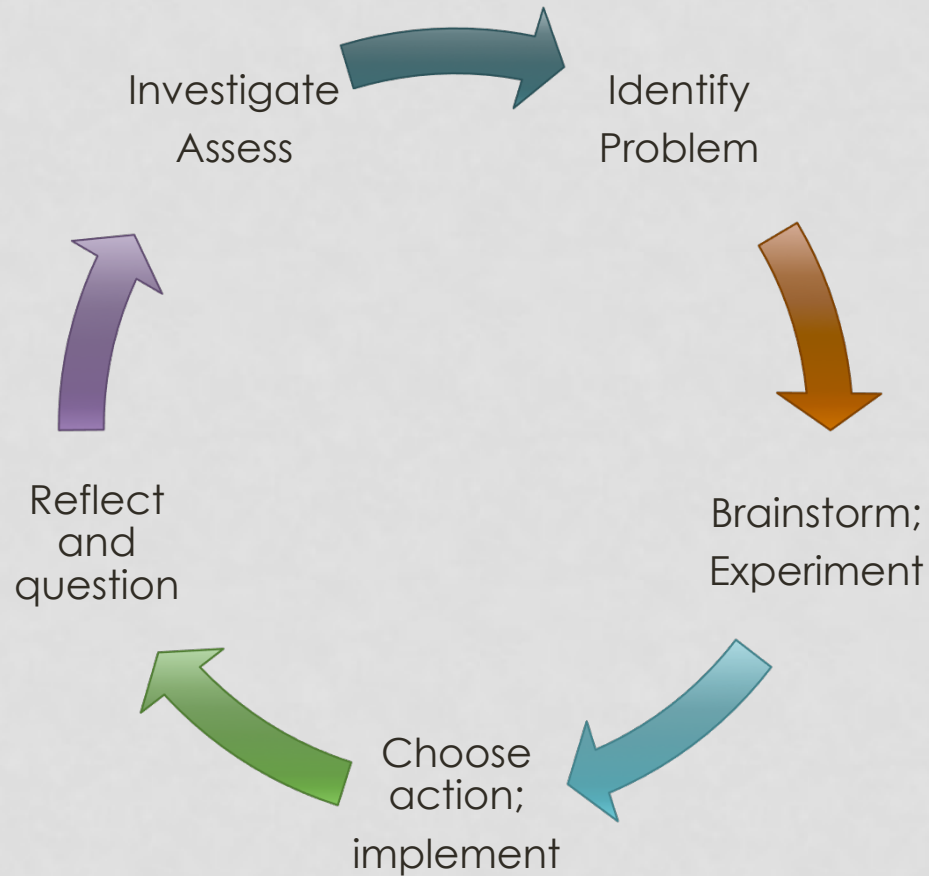


Weekly course meetings

Teaching
Apprenticeship

Practice First Class with audience

BETTER NOW?



AIMING FOR EXCELLENCE

- In the fall of 2005, with the support of the senior faculty, we started a pedagogy seminar for all first year graduate students
- (This arose from a brainstorming activity and began with a pilot.)

PEDAGOGY SEMINAR

- **What does excellence look like to you?**
- **Class observations + blog**
- **Who are our students? Working with struggling students**
- **Teaching through questions: Bloom Taxonomy**
 - **Ask! Don't Tell.**
- **Learn about how people learn**

PEDAGOGY SEMINAR

- **Communication ~ verbal and non-verbal: affect has effect**
- **Iterated microteaching**
 - **Observation and reflection~ individual video consults**
 - **Choreographed so grad student can follow microteaching by a class visit on the same topic – and have live student audiences**
- **Advice from/ conversation with experienced TFs**
 - **Passing down a culture**
- **First class observation and discussion**

2006: STUDENT INTERVIEW PROJECT

- Interviews aim: understanding the perspective, experiences, and attitudes of our students, particularly unhappy students
- 80 students interviewed individually;
- information gathered informs our choices
- impetus for change: points of dissatisfaction and misalignment back in 2006.
 - (interviewer: Andrew Dittmer, a grad student)

FINDINGS OF 2006 INTERVIEWS

- **learning and understanding vs. memorizing**
 - Teachers saw big distinction; students saw little distinction
- Department offers an abundance of resources but work needed to **connect students to resources.**
- Dissatisfied students complained most about **communication issues**, often, though not exclusively, in the context of international teaching fellows.

THE CALCULUS COACH PROGRAM

- Problems provide impetus for innovation: the first calculus coach
- Attacking two problems at once:
 - Pairing our teachers in most need of more hands on work and our students in most need of more personal help
- The coaching programs aligns the needs of our graduate TAs with our undergraduates (from whole course)
- The coach participates all semester in the class of a “master teacher”

INGREDIENTS FOR SUCCESSFUL COACH

- Personal empathy and understanding
- Mathematical understanding of the root of a student's problems
- Getting immediate feedback of whether an intervention is successful
 - If not successful, try again
 - If calculus students drop out; you're not a success.

SUPPORT SYSTEM

TF in his/her own Classroom

Pre-semester calculus orientation

Midterm feedback

Teaching observation

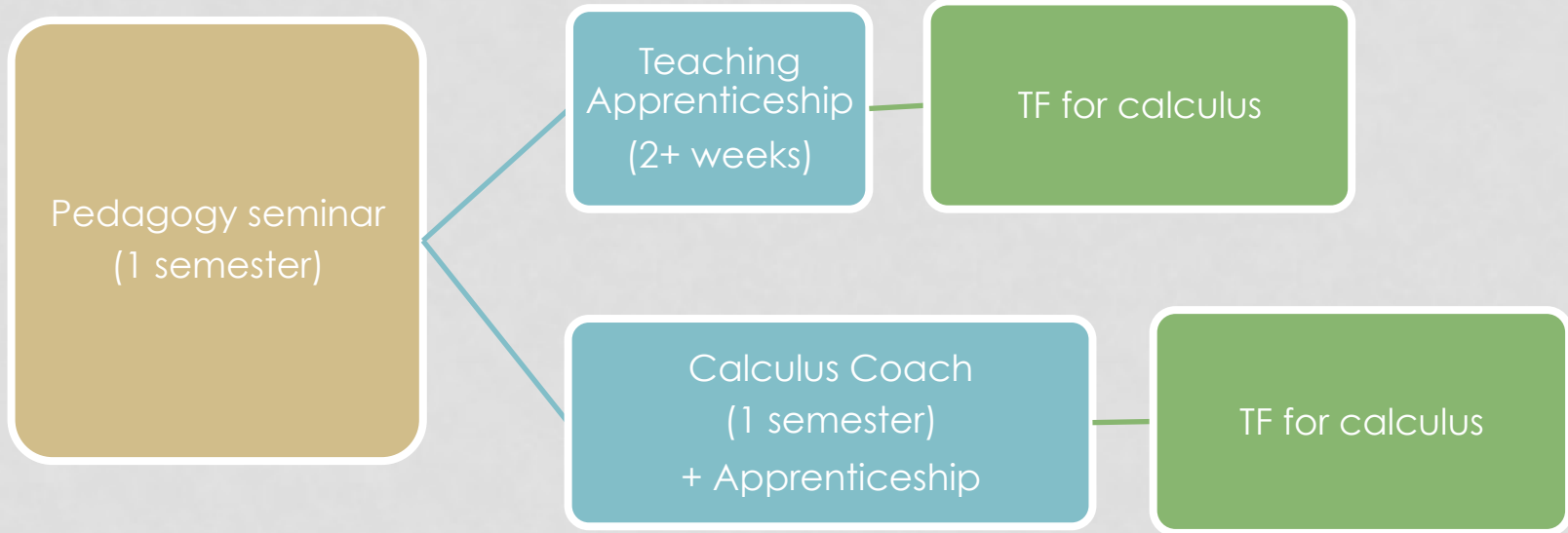
Weekly course meetings

Teaching
Apprenticeship

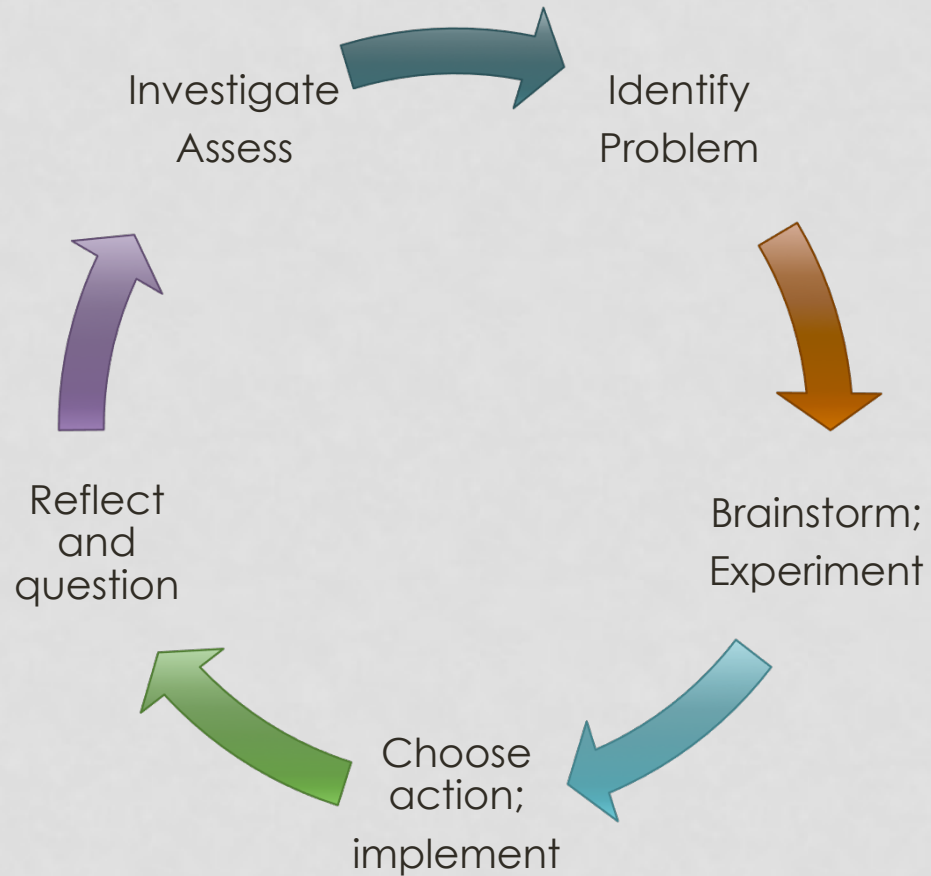
Practice First Class with audience

Pedagogy Seminar

PATHWAYS TO THE CLASSROOM



BETTER NOW?



PROGRAM IMPACT

In 9 years, three graduate Levenson Award winners
all non-native speakers,
all previously calculus coaches.

- *With the **support of the senior faculty** and **help of key graduate students**, the program has successfully **changed the culture of the graduate students around teaching.***

This, in turn, has broader positive impact – on our undergrads & when our graduate students become faculty members themselves.

DUKE'S GRAD STUDENT TEACHER MENTORING

- Developed over the years ~ started by Jack Bookman:
- This presentation will give the current state of the program

PROGRAM GOALS:

- Develop an understanding of undergraduate students' cognitive and social development in order to support academic development
- Develop effective verbal, nonverbal, written, technological and media communication skills to support and enhance student learning.
- Understand the role of assessment and the use of formal and informal assessment strategies to evaluate student learning.

PROGRAM GOALS CONTINUED

- Learn how to develop instructional plans to effectively address students' needs, curricular goals, and content.
- Recognize student diversity and develop strategies for creating an inclusive classroom.
- Develop the habit of reflecting on interactions with students in and outside of the classroom

PROGRAM GOALS: PROFESSIONAL DEVELOPMENT

- Understand the role of the instructor in promoting student learning, assigning grades, working within the structure of a multi-section course, and working within the policies of the university.
- Develop a productive system for the management of TA's.

FIRST YEAR

- New graduate students are welcomed by the chair of the calculus committee
 - Given brief history of the program and development of lab calculus
 - Given an overview of GTA support and development
 - Given an introduction to labs (example lab worked through)
- Training Week
 - Anyone who will be teaching in the calculus program that academic year participates
 - This includes all new graduate students

FIRST YEAR

- Training week sessions include:
 - Written lab reports and grading writing
 - Grading exams and consistency
 - Meetings with course supervisors
 - Meeting with TAs
 - Challenging Scenarios in the classroom
 - Intro to online management systems
- First year students also
 - do a practice teaching observed by peers and faculty, sometimes schedule changes follow
 - Participate in TA training with undergraduate TAs

FIRST YEAR

- **Pedagogy Seminar**

- Meets for 50 minutes three days per week
- Major components:
 - Set teaching related goals for the term
 - Presentations in class for peers with feedback (3)
 - Observations from lab work and classroom visits with reflections
 - Reading/Activity assignments with reflections
 - Writing and implementing effective lesson plans
 - opportunities to check student understanding
 - Writing quiz and test questions

FIRST YEAR

- Pedagogy seminar
 - Visits by folks outside the department:
 - Other opportunities for professional development
 - The graduate school
 - Campus Resources for students
 - Academic Resource Center
 - Inclusive classrooms and implicit bias training
 - Office of Institutional Equity
 - Undergraduate student panel
 - Graduate student panel

FIRST YEAR

- Spring term
 - Practice teaching in a classroom
 - Usually two lessons
 - Meetings with teaching faculty and possibly mentors follow
 - Revisit teaching related goals set at start of pedagogy seminar
 - Reflect on whether the goals were met, how they can be revised for next year

PATHWAYS TO THE CLASSROOM

Pedagogy
seminar
(1 semester)

Spring
practice
teaching

Instructor of
Record
for calculus

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graph LR; A[Pedagogy seminar (1 semester)] --- B[Spring practice teaching]; B --- C[Instructor of Record for calculus];
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CONTINUED SUPPORT

- Training week
- Weekly teaching meetings with course supervisor
- Open communication with POP team and Supervisor of First Year Instruction
- 1-3 teaching observations during first semester teaching
- Team writing and review of midterm exams
- Review and challenge of final exams

- At end of first semester teaching, evaluations are read with a teaching faculty and teachers write a reflection

CONTINUED SUPPORT

- Spring workshops
 - Inclusive classroom practices and implicit bias training
 - Aligning teaching to goals for assessment

DIFFERENT PIECES MEET NEEDS AT DIFFERENT INSTITUTIONS

- **CoMInDS**: College Mathematics Instructor Development Source
 - Goals
 - Create a web-accessible resources suite
 - Create and foster communities of practice
 - Scholars, providers, GTAs
 - Provide workshops for providers of TAPD
 - Provide webinars for GTAs

DIFFERENT PIECES MEET NEEDS AT DIFFERENT INSTITUTIONS

- Survey with Progress through Calculus
 - DUE Award # 5345008
- There were 18 questions about GTA PD
 - 85% of PhD granting institutions and 49% of Masters granting institutions have a GTA PD program in the Math Department
 - 83% of all institutions use materials that are developed by providers at the institution
 - 38% use published material
 - 10% use material adopted from another institution's program

WHAT WE'VE LEARNED FROM COMMUNITIES OF PRACTICE

- People like meeting in person
 - Ideas and materials are exchanged
 - The conversation is refreshing and energizing
- It's hard to keep up the momentum on listserv in between face to face meetings
- QUESTION:
 - What shape could online communities take?

THANK YOU!

- questions?
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- (if you'd like to join a CoMInDS mentoring group – e-mail Emily: braley@math.harvard.edu)