

**USING CASE STUDIES IN
SEMINARS ON COLLEGE TEACHING**

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INTRODUCTION

Excellent teaching contributes to all aspects of an institution's mathematics program. It is crucial to meeting the needs of non-mathsci majors. This session will be concerned with the teaching development of both graduate students and faculty. Our question is:

How can we stimulate mathematics instructors to understand and successfully embrace the challenge of teaching, especially non-mathsci students?

Teaching development must be concerned with many complexities:

- Students are taught by a variety of instructors, including regular faculty, graduate students, and adjunct faculty.
- Experienced faculty may be set in their ways.
- Beginning teachers may not be aware of the main issues.
- Department cultures vary widely as regards valuing teaching, and as regards valuing innovation in teaching.
- University-level teaching development is a recent innovation.
- There is no one right way of teaching, nor is there one approach that is guaranteed to work for all.

This diversity suggests a need for open-ended materials which may be used in a wide variety of ways, which may be fit in to each institution's TA or faculty development programs.

Graduate students and young faculty, in particular, frequently have limited access to experiences with students who:

- **are not highly motivated to learn mathematics.**
- **have weak prerequisite skills.**
- **do not learn mathematics quickly.**
- **do not learn mathematics comfortably in a traditional lecture format.**

To make a program (for graduate students or for faculty) which is effective:

- Books of teaching advice seem to have limited impact.
- Even experienced teachers find it difficult to address pedagogical issues which are outside their own *experience*: “The main barrier or constraints to changing practice seemed to be teachers’ deep-seated ideas about content and pedagogy and their limited access to experiences and external contacts that would help them develop alternative conceptions of knowledge and pedagogy.” [Elmore, Peterson, and McCarthy, Restructuring in the Classroom, 1996.]

This suggests the need for an *experience-based* approach.

CASE STUDIES

A *Case Study* is an excerpt from a teaching situation that focuses on and describes one or more of the following: the teacher's behavior, student responses, student learning or mislearning, classroom management, instructional content or practice, the relation between teacher, students, and the TA.

Each Case raises a variety of pedagogical and communication issues, to be explored through group discussion and analysis (though they can also be read independently).

The use of Case Studies is common in business and law, disciplines where decision-making skills are crucial. They have been used for over 30 years in the training of university faculty. The Boston College Mathematics Case Studies Project (BCCase) has created cases directed at mathematics graduate students.

WHY USE CASE STUDIES?

Case studies discussions give participants the chance to

- (1) Analyze complicated realistic teaching situations (perhaps applying general principles they have formulated or discussed).
- (2) Analyze classroom interactions and approaches which involve non-mathsci students.
- (3) Think in advance about how to handle teaching crises so that they can deal with them when they arise in real life.
- (4) Formulate their own approach to teaching.
- (5) View teaching as non-trivial and sometimes ambiguous, and as something to talk about.

Just as learning mathematics requires exercises,

Case Studies are the exercises for teaching

...if you work on them now, there's a very good chance that you will do well on the exam. (And along the way, you'll learn how to think about the subject.)

Arizona, the University of California at Santa Barbara, the University of Chicago, the University of Illinois at Chicago, the University of Michigan, the University of Oklahoma at Norman, the University of Massachusetts, the University of New Hampshire, the University of Washington, and Virginia Tech.

Results to Date

- (1) The cases can be an effective way of promoting thought and dialogue about teaching.
- (2) Graduate students, including foreign students, can discuss them effectively. They can provide a window for such foreign graduate students to American university culture.
- (3) Beginning graduate students may not have the experience base to discuss all cases; for these cases it is very useful to have some more experienced participants in a case study discussion.
- (4) Case studies provoke spirited discussion among even experienced faculty, which they find useful in their own teaching development.
- (5) Case studies may be used effectively with math ed students.
- (6) There is a learning curve to leading a case study discussion.

AN EXAMPLE: ORDER OUT OF CHAOS

Case Synopsis

Terry is teaching her own section of a pre-Calculus class. During a previous class meeting, she introduced the idea of horizontal translations of functions beginning with parabolas, and assigned a set of functions to be graphed for homework. To begin today's class meeting, she asks for volunteers to put sketches of some of their graphs on the board. Unexpectedly, some of the sketches are incorrect, and the ensuing discussion reveals that more than a few students are unclear as to the relationship between the graph of a function, $f(x)$, and the graph of its translate, $f(x - a)$.

Key Issues in this Case

- (1) Probing student understanding and errors.**
- (2) Developing students' ability to "reality check" their calculator output.**
- (3) Time and classroom discussion management.**

Secondary Issues

- (1) Additional approaches to developing student understanding of translations and more generally, transformations.**
- (2) Communicating the usefulness of such material to non-mathsci students.**

Hi Sol,

Thank you for participating and leading a great discussion of the role of graphing calculators. The case you presented was a good fit with current class discussions about student learning, teacher scaffolding and the role of technology in students' mathematical understanding.

The case you presented was timely because it served as a primer for the next assignment in which students will complete a case analysis of a mathematics teaching situation. Your discussion gave students ideas regarding how to approach the case. My students expressed their disappointment that you will not be teaching next semester. They certainly like your instructional style.

I think that a next step is to have a Brown Bag with some colleagues from my department and your department. Let me know if you are interested.

Sincerely,

Lillie

For More Information

- (1) For information about leading a case, as well as for the case studies we have written, please consult our book Teaching Mathematics in Colleges and Universities: Case Studies for Today's Classroom, Issues in Mathematics Education Volume 10, 2001, available in faculty and graduate student editions from the AMS and from the MAA.
- (2) For a wwboard concerning the experiences of case-studies users, and for other information on the cases, please see our website: www.bc.edu/casestudies.
- (3) We have made a video about how to use case studies. Please check our website or contact me for more information: friedber@bc.edu.

Plan for Breakout Session

- **Experience a Case Studies discussion**
- **Video of graduate students in a case studies discussion**
- **Leading a Case discussion**
- **Including Cases in your institution's teaching development program.**