

# M602: Teaching college math

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**We are a community.**

We explain, argue, and persuade

We collaborate

We critique

We hold each other **accountable**

**We are mathematicians.**

We ask questions

We **wonder** about the world—the “real” world and the world of mathematics

We create and use **models, tools, and strategies** to mathematize the world

We are **sense-makers**

We experience **confusion, anxiety, and joy**

**We are teachers.**

We approach pedagogical interactions as **teacher-learners**

We find the right **models, tools, and strategies** to help people learn

We seek to foster **wonder, perplexity, and understanding**

We're not afraid of a little **confusion or anxiety**

We treat all learners as **people** and promote their development as people

We are a **community** • We are **mathematicians** • We are **teachers**.

# “The status quo is unacceptable”

So concluded the *Common vision for undergraduate mathematical sciences programs in 2025* project. This project brought together five professional groups from the mathematical sciences: the American Mathematical Association of Two-Year Colleges (AMATYC), the American Mathematical Society (AMS), the American Statistical Association (ASA), the Mathematical Association of America (MAA), and the Society for Industrial and Applied Mathematics (SIAM). Together they produced a devastating critique of contemporary pedagogical practice in the mathematical sciences, and a compelling call to action to do something about it.

That’s why we’re here.

We’re here because we are not satisfied with the status quo, in which<sup>1</sup>:

- Each year only about 50 percent of students earn a grade of A, B, or C in college algebra (Ganter & Haver, 2011).
- Women are almost twice as likely as men to choose not to continue beyond Calculus I, even when Calculus II is a requirement for their intended major (Bressoud, 2011).
- Students of color are vastly underrepresented in the cadre of bachelor’s degrees awarded in the mathematical sciences ([www.nsf.gov/statistics/nsf07308/content.cfm?pub\\_id=3633&id=2](http://www.nsf.gov/statistics/nsf07308/content.cfm?pub_id=3633&id=2)).

We’re here because we know that we can do better:

- Students in classes with traditional lecturing are 1.5 times more likely to fail than students in classes with “active learning” (Freeman et al., 2014)
- On average, student performance increases by just under half a SD with active learning compared with lecturing (Freeman et al., 2014)
- Students in inquiry-based math courses experience greater gains in understanding, confidence, persistence, and positive attitude about mathematics, as compared to student in classes with traditional lecturing (Laursen, Hassi, Kogan, & Weston, 2014)

Changing the status quo is a moral and ethical imperative. Mathematical literacy is a civil right (Moses & Cobb, 2001). Students deserve better from the mathematical sciences.

Changing the status quo is an existential imperative. Simply put, mathematics *needs* students (Gutiérrez, 2006). We maintain the status quo at our own peril.

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<sup>1</sup> Excerpted and summarized from p. 3 of Saxe, K., & Braddy, L. (2012). *A common vision for undergraduate mathematical sciences programs in 2025*.

## Learning outcomes/course objectives

The main outcome of the course is that **participants will *develop as reflective mathematics educators***. Development involves the acquisition of knowledgeable skill, but it's much bigger than simply knowledge. Development involves *becoming* a member of a community, and thus it affects not simply what we *know*, but also who we *are*. Therefore, development cannot be reduced to an enumerated list of learning outcomes nor can it be standardized across participants.

We develop as members of a community as we participate in the practices of that community. Thus, rather than thinking about the course in terms of *outcomes* to be attained, it is better to think about the course in terms of *practices* to participate in. During the course, participants will:

- Reflect on and discuss philosophies of mathematics, perspectives on learning, and models for teaching college mathematics, with a focus on recent efforts to reform teaching college mathematics as advocated by the AMS, MAA, College Board of Mathematical Sciences, and mathematics education research.
- Participate in teaching practice by:
  - o Facilitating classroom activities and reflecting on the experience
  - o Develop artifacts of practice, including artifacts that can be used in future teaching, and a coherent teaching philosophy that can be used when applying for academic jobs
- Consider the purposes and uses of multiple types of assessments, and explore ways to use assessments to support learning

## Administrative things

**Class time:** MWF 11:00-11:50 PM

**Location:** MATH 108

### **Text:**

1. Collected readings, which will be posted in PDF form on the course website.
2. Book of your choice related to math teaching and learning, from a list provided by the instructor

**Final exam period:** Wednesday December 14, 8:00–10:00 am

## Tentative schedule

This schedule is subject to change, in order to be responsive to ideas and issues that surface as we go through the course. The assignments are described in the next section

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Unit	Assignments & Deliverables
<i>Unit 1: Mathematics as a human activity</i>	<ul style="list-style-type: none"><li>• Reflective journal</li><li>• Teaching experience #1: Engaging in mathematical activity</li><li>• Peer- and self-assessment of teaching experience #1</li></ul>
<i>Unit 2: Mathematics as a cultural product; the intertwinement of activity and product</i>	<ul style="list-style-type: none"><li>• Reflective journal</li><li>• Teaching experience #2: Learning by reinventing</li><li>• Peer- and self-assessment of teaching experience</li></ul>
<i>Unit 3: How mathematical objects become meaningful</i> <ul style="list-style-type: none"><li>• The role of representations</li><li>• The role of collaborative learning</li><li>• The role of telling</li><li>• The role of practice</li></ul>	<ul style="list-style-type: none"><li>• Reflective journal</li><li>• Artifact of practice: Hypothetical learning trajectory</li><li>• Teaching experience #3: Engaging in productive social interaction</li><li>• Peer- and self-assessment of teaching experience</li><li>• Artifact of practice: Practice set</li></ul>
<i>Unit 4: Grades and assessment</i>	<ul style="list-style-type: none"><li>• Reflective journal</li><li>• Artifact of practice: Grading policy for syllabus</li><li>• Artifact of practice: Assessment</li></ul>
<i>Unit 5: Coda</i>	<ul style="list-style-type: none"><li>• Artifact of practice: Statement of teaching philosophy</li></ul>

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## Assignments

### **Reflective journal**

Each participant will maintain a journal in which they chronicle their development as a reflective educator over the course of the semester. The journal may be hand-written or typed, and will include both in-class entries and out-of-class entries. In many cases, you will respond to prompts. However, you are also free to document your own reflections.

The journal will be turned in at various points during the semester and at the end of the semester. I will return the journals at the start of the Spring 2017 semester.

### **Teaching Experiences**

Participants will choose a focal area (e.g., Calculus, Discrete Math, Contemporary Math, Abstract Algebra, etc...) and collaborate with one or two peers to facilitate classroom activities from that content area with the class. Each teaching experience will have a different pedagogical focus. Each will be accompanied with self- and peer-assessment/feedback. We will discuss the expectations for teaching experiences in more detail in class.

### **Artifacts of practice**

Participants will create practical artifacts that can be used in future teaching experiences. We will discuss the expectations for each artifact in class.

## Feedback and grading

There are no quantitative grades here. I will provide descriptive feedback on most assignments.

Rather than assigning different grades for different qualities of work, my expectation is that everyone will get an "A." I will work with each of you to make sure you arrive at "A-quality work." You will revise your work, possibly multiple times, until you do.

### **A note on timing**

In general, you should plan to spend approximately 6 hours each week outside of class on work for this course. Deadlines are in place to keep everyone on track, but if something is not reasonable for you we can negotiate it.

## Policies

**Communicating:** Email is the best way to reach me. UM policy states that I must use your UM email account when I correspond with you. Please email me from your UM account—that makes it easy to follow the policy! Even if you don't, I still have to reply to your UM account.

**Attendance/participation:** You are preparing for a profession in which timeliness and attendance are strict and non-negotiable. In addition, we will do important activities each day. For these reasons, I expect that you attend every class. Things come up, and I understand that. If you know you are going to miss class, please make arrangements with me before hand. If you miss a class that you didn't expect to, please contact me as soon as you can so we can arrange a makeup activity.

**Classroom and testing accommodations:** The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students. If you think you may have a disability adversely affecting your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or 406.243.2243. I will work with you and Disability Services to provide an appropriate modification.

**Academic honesty:** All students need to be familiar with the Student Conduct Code. You can find it in the "A to Z Index" on the UM home page. All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University.