My questions

How do students learn? How should we teach? These are the driving questions of my life as an educator.

These are not easy questions! I read voraciously about them, trying to learn from others’ studies and anecdotes and ideas, always thinking about how to best use the precious three sessions of 50 minutes per week that I have with my students.

My passion

I am passionate about inquiry-based, student-centered learning. I learned math in this way — my high school curriculum consisted entirely of word problems, carefully constructed to build ideas — and I loved it. I have taught high school students in this way, and I have taught high school teachers to teach in this way. My dream is to write an inquiry-based curriculum for my own courses, so that I can also teach college students in this way.

After all, this is how we learn — by thinking hard about interesting problems. This is how we do mathematics — we build on our previous understanding to reveal new structure and discover new results.

My dream

In my dream for an ideal course, students are assigned homework problems every night, and come in to class to discuss them. Class time consists of each student in turn presenting their (complete or partial) solution to one of the problems to the class. The other students ask questions about the solution, suggest alternative methods, and so on. The problems are designed to gradually introduce the new concepts of the course, building on previous concepts, and in class the students learn to discuss mathematics with others and clearly explain their ideas.

Transitioning students into this learning method is not always smooth, because many students prefer to be passive. Transitioning the curriculum from definition-theorem-example lectures to classes with problem presentations is not always smooth, because we need to write good problems that flow and reveal the material well, and students need to learn skills of problem solving and mathematical explanation. Yet I think this is a journey well worth taking.

My experience

I have been the primary instructor at Northwestern University, Brown University and Phillips Exeter Academy. At each of these institutions, the students are bright and motivated — they would learn with any teacher, and any method. My goal is to push them beyond just learning, to asking their own questions and shaping their own discovery.
I especially enjoy working with students who do not believe in their own abilities: at the beginning, they say they are “not a math person,” but within a week they are discussing solutions with their classmates, and over the course of the semester they come to enjoy thinking about math, and appreciate their own abilities. I have seen this happen with students in many demographics — female students, students who haven’t taken math in five years, students from countries where education is not valued, students without a strong background, and so on. As long as we engage them, they will become mathematicians, even if only for the semester.

Our reality

In our honors freshman linear algebra and multivariable calculus sequence at Northwestern, I have received higher and higher student evaluations on my lectures every quarter. This fall as course head, I have changed our curriculum so that the students do problems in groups one day a week. It is working — they are solving harder problems than last year’s students, with more success than last year’s students, and they are happier while they are doing it.

This spring, I will pilot one section of the type of course described above. Next year, I am willing to lecture, especially when I am learning about a new department, the students, and the course that I am teaching. Gradually, I would like to introduce more active learning into the course, until the students are leading the discovery of new concepts, and my role is to help them do this.

If you would like to create a curriculum where your students learn by solving problems, and where they learn to discover mathematics and explain their ideas to others, I would love to help you do it. If you would like to try new ideas for creating an innovative mathematics curriculum, and learn from our experiences year by year to create courses that are best suited for your particular math students, I would love to do it with you. This work is really worth doing, and I am so excited to work hard to make it happen.