

Teaching Statement
Julia Bergner

"I liked the opportunity to see WHY things worked before just getting the formulas!"
--participant in Infinite Mathematics Project, 2007

"Dr. Bergner showed a high interest in our understanding the material holistically."
--History of Mathematics student, 2006

"She helped make us more able to understand the math behind the math."
--Mathematics for Elementary School Teachers student, 2005

One of my favorite aspects of teaching mathematics is helping students to understand the concepts underlying the topic at hand. I believe this attitude comes from my own appreciation of opportunities to see the big picture of mathematics and the way that different pieces of mathematical content fit together. When I begin teaching as a graduate student, I discovered that I really enjoyed interacting with students and sharing my enthusiasm for mathematics with them. While the subject matter varied, I loved talking about mathematics, whether it was in a calculus class, an informal graduate student seminar, or a research presentation. As I have continued in my career, I have found that this attitude has not changed, and I have found a still wider range of audiences. I have worked extensively with in-service teachers, have given hands-on presentations for middle school girls, and have met at length with graduate students in my office.

As a graduate student, I taught a lot of calculus, usually in coordination with other instructors. In this setting, I primarily focused on being a good lecturer. I tried to explain concepts as clearly as possible and give lots of examples. Furthermore, I made it a priority to learn my students' names and be enthusiastic about the material. A few times a semester I would bring homemade cookies to class, often shortly before an exam.

As a postdoc, I have been teaching a wider variety of classes, and for the first time, I've really needed to evaluate the techniques I am using. I have an unusual postdoctoral position, one in which I am teaching and pursuing my research, but also participating in outreach to teachers. I'd like to focus on four different populations that I have had the chance to teach in my time here: pre-service elementary teachers, pre-service secondary teachers, in-service teachers, and graduate students.

In my first semester at Kansas State University, I taught mathematics for elementary school teachers, which was very much a new experience for me. While the students came from wide range of levels, I realized that it was crucial that these students really understand the mathematics that they plan to teach. In that semester, I made three major changes to my usual approach to teaching. In order to help them learn how to read mathematics more effectively, I asked the students to read a section of the book and turn in an index card of notes on it each day. I also had a prepared activity for the end of class so that the students had a chance to work problems before they left the class. Sometimes this activity consisted of practice problems, but other times it was an exploration of the topic on a deeper level. Still other times I asked them to reflect on material that is traditionally difficult for children to learn and think about how they might help students in these areas. Lastly, I required the students to do a project of their choosing, which included both a write-up and an in-class presentation. Especially for the students who claimed to hate everything about mathematics, part of the purpose of this project was to give the students an opportunity to find something in mathematics that they really enjoyed.

This fall, I am teaching a contemporary mathematics course in which the majority of the students are elementary education majors. I am again using these three approaches, but I am trying to improve on them. For example, for the note cards, I am giving the students specific questions to answer and requiring them to ask questions of their own. The topics covered in the course include voting theory, graph theory, and statistics, and my hope is that the students leave

the class with a broader understanding of what mathematics is, in particular that it goes far beyond arithmetic computations.

In my second semester here, I encountered another distinct population of students when I taught a history of mathematics course primarily intended for future high school teachers. The course content was a mixture of mathematics and history, and the students read primary texts, which they discussed in small groups in class. I found that I particularly enjoyed reading student essays because it gave me a sense of the way that they were thinking about the course material in a way that ordinary homework assignments could not.

This semester, I am teaching a geometry course which is also designed for secondary education majors. For the first half of the semester, the students are presenting proofs of basic theorems in Euclidean geometry. This approach is a new one for me, both in the extensive time spent by students working in collaborative groups, and in the fact that the students spend more time presenting at the board than I do. In the second half of the course, we will work with Geometer's Sketchpad and look at the basic ideas of non-Euclidean geometry.

In my first summer here, I team-taught a two-week course for in-service teachers, which proved to be very different from any other teaching experience I had ever had. For example, they asked far more questions than typical college students and were more likely to slow me down until they understood the material.

This past summer, I was the primary instructor for a similar course, one for which I helped write the MSP grant funding it. Because some of the participating teachers were working towards gaining calculus credit for their certification, I taught a course on the major concepts of calculus. We began with sequences and series, proceeded to limits, and then covered derivatives and integrals, with an emphasis on how the roots of these ideas can be found in the elementary and middle school levels. One major feature that I added to the course this summer was breaking the students up into sections halfway through the session; I would ask them to divide themselves into two groups based on how confident they were on the material covered so far. Especially because these teachers varied widely in their mathematical background, this format allowed them to continue the material at a pace appropriate to their level of understanding, which many of the teachers appreciated.

Last fall, I had the opportunity to teach yet another very different kind of class, a graduate course in algebraic topology, I incorporated an independent project into the course; each student was asked to read a paper relevant to the content from class and either write a short summary of the paper or present a talk in the graduate student seminar. The intent of these projects was to give the students an opportunity to learn in more depth topics of interest to them and possibly related to their own research areas. Teaching the course also gave me the opportunity to be involved in the writing and grading of the departmental qualifying exam in topology.

In the spring semester, I had the opportunity to follow up the algebraic topology course with a topics course, in which I discussed the basic ideas of stable homotopy theory. While I had originally planned to discuss ideas more central to my own research, I concluded that it was not as suitable for the students enrolled, most of whom were studying representation theory. I again asked the students to read outside papers, and this time I asked that all the students give talks.

Having had these experiences with a variety of different courses, I feel confident in my ability to teach different kinds of mathematical content to different populations of students and to improve my teaching methods and style further. I am a 2006-07 Project NExT Fellow, which has given me the opportunity to learn about a variety of approaches to teaching and different methods to use in the classroom. This interaction with other young mathematicians has strengthened my enthusiasm for teaching and mentoring students and being a part of the mathematical community.

Further information on my courses can be found at:
<http://www.math.ksu.edu/~jbergner/Portfolio07.html>