

Teaching Philosophy

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My teaching career has seen many stages. Several years ago, I found that I had a talent for it when my high school math teacher asked me to help several other students in geometry and algebra in order to prepare them better for the SAT. It was fascinating to watch people go through the same thrill of discovery that I enjoyed as they struggled through problems. In the summer prior to graduate school, I was involved with the Howard Hughes Medical Institute's program for high school students under-represented in the sciences. I spent that summer instructing sixth through eighth graders in computer science at the University of Georgia and learned a great deal myself about how to get challenging students interested and involved. Since then I have taught differential equations, calculus, pre-calculus, college algebra, and liberal arts math in a variety of settings. In addition, I have assisted by grading and sometimes lecturing in other courses such as sequences and series, complex variables, and linear algebra. I was also lucky enough to be able to contribute to the development of calculus labs using Maple as a graduate student. This past August I was selected as a Project NExT fellow for 2001-2. This honor has given me the opportunity to meet many other talented educators from around the country and enhance my teaching by drawing from the variety of teaching styles that this network possesses. Many of the great ideas I encountered at MathFest during the Project NExT workshop and afterwards made it into my classes this fall.

At Duke, the most dramatic change for me as an educator has been to become more involved with curriculum development. I have served on the calculus committee, participated in the revision of the freshman calculus program, and worked on more extensive Maple modules and online material for the Connected Curriculum Project (for more information please see <http://www.math.duke.edu/education/>). In the fall, I supervised all sections of second term calculus under the direction of Lewis Blake. My most exciting project so far has been the opportunity to test this Maple based material I have developed for multivariable calculus in an Interactive Computer Classroom designed around twenty computer workstations to be used by students (for more information please see <http://www.aas.duke.edu/admin/icc/>). This class allowed for me to teach in an entirely different paradigm where students can truly explore concepts interactively under my guidance in a problem-oriented environment. The class taught me a lot about how students perform in non-traditional learning environments. We covered material up to and including the Divergence theorem and based on the final exam given at the end roughly fifty percent of the students had good mastery of the material. Only two out of the twenty-two students seemed to have struggled with the combined format, but they eventually overcame their difficulties. The curriculum for this multivariable calculus section consists of html modules for various topics with Maple worksheets that guide students through exercises that include applications of various topics. Students responded well to learning material from these self-guided projects and modules but still needed direction from the instructor and complained somewhat about the extra workload. I am interested in working with this model for instruction again to make

improvements. The next step in the process will be to design better assessment tools and to expand on the amount of lecture material available. Striking the appropriate balance between student discovery and guided exploration seems crucial to success in such classes.

These types of activities have turned teaching into an ongoing process of exploration for me. When I began teaching formally my main focus was an accurate and understandable presentation of mathematical facts. This worked well, but as my experience grew, I came to realize that while teaching has a core element that relies on the ability to disseminate information concretely and correctly, a whole world beyond this exists where the communication of ideas can be constantly improved upon. Since coming to Duke I have had the opportunity to try many new things and it has opened a new world of possibilities to me. Andrew Granville once characterized me as a “born calculus teacher” in his evaluations but after working with people like Lang Moore, Jack Bookman, David Smith and Lewis Blake and listening to their ideas I realize that I was only looking at the most basic mechanics of teaching. They have suggested to me a variety of ways to improve and more to the point enhance the learning experience for students. Through discussions with them I have learned about theories of learning in addition to the finer mechanics of concept oriented instruction. The innovative calculus curriculum at Duke has allowed me the opportunity to engage the students with in class exercises, projects, computer-aided demonstrations and more online resources. I have made an effort to make sure all these activities take place within the concrete framework of a continuum of clearly presented ideas. This last point can be quite a challenge while trying out new ideas but it is especially important non-traditional teaching environments. It seems that students need a rigid foundation on which to rely but flourish most in a dynamic and challenging atmosphere. The most effective version of this delicate balance that I have found allows students to struggle with a series of problems that I then link together. This approach gives students a firm understanding of the topics since they are more actively involved in the process instead of passively absorbing material.

Throughout all this experimentation, the strong point of my teaching remains my lecture style. I tend to give outlines of concepts and use examples to illustrate important points. During this process I like to involve the students by getting them to help develop ideas. This question and answer theme was instilled in me by several of the excellent teachers I had while at the University of Georgia. Ultimately, though, the bottom line in teaching is to impart understanding. I feel like I have been successful in doing that and my evaluations, both from students and mentors, have been positive. I was awarded two teaching awards as a graduate student. Comments on these evaluations have provided me with support in my efforts while giving me the feedback I needed to correct problems that sometimes I was not aware of. For example, Gordana Matic reviewed my teaching once and commented that while my lectures were clear and I kept students involved, I could improve my effectiveness by challenging the students more without letting on that they were being challenged. She recommended that I simply present the material well and let the students benefit from struggling with tough problems. I had never really considered the process of learning in this way and it made me aware of a new dimension in the teaching process. I tried this and

was pleased to find that students responded by reaching to a higher level. As a result, I have been able to respond to the increased abilities of the students at Duke more effectively as well. Students have also helped me develop my teaching environment. Their criticisms have helped me refine my test writing and have helped me experiment with various homework approaches and, while my evaluations have always stayed in the 90% positive range, I realize that there are always subtle variations in courses that need to be addressed. As you can see from my focus on teaching in computer-based environments, perhaps the most exciting aspect of teaching for me right now is the integration of technology into students' explorations. I have used web-based resources (please see <http://www.math.duke.edu/~ef/>) to supplement the classroom for students since graduate school. Primarily, these online resources provide a conveniently accessible information source for students that includes practice problems, syllabus information, topic outlines and exam solutions. Recently, I have begun using the Blackboard CourseInfo online course content management software to coordinate the web component of my classes. This software enables online student collaboration, group work areas, digital assignment submission and online grade access for students. I have found that this extension of the classroom helps enable a community atmosphere in my classes. My experiences at Duke have also enriched the way I think about using the web in and out of the classroom. Much of this has come about as a direct result of my involvement in the Connected Curriculum Project and teaching in the ICC this fall.

In the future, I envision teaching classes at all levels in a way that develops a community ethic among students. As computers and PDA type devices become more prevalent and can be integrated into the learning process in ways that are less taxing on the overall effectiveness of instruction, we can hopefully advance to a point where all the core topical information will be available to students on demand with rich cross-disciplinary connections to information relevant to their own interests. This process would have a synergistic effect on the process of learning that would allow all branches of intellectual thought to benefit from the enhanced interconnectedness. I feel that one of the things most beneficial to students is the feeling that they are a group who can develop their understanding with me acting as a mentor-guide. I enjoy teaching a great deal and I find it an honor to be able to help someone see the point of a subject that I myself enjoy so much. I hope to be able to continue and keep expanding upon my role in education in the future. I am especially eager to put some of the techniques I've learned to use in upper level and graduate courses, although I will always be looking for ways to connect to students who are not as mathematically inclined as majors are. I would also like to become more active in advising and other major oriented activities, especially research related projects. This would allow me to combine the joy I get from teaching with the joy I get from research and would perhaps be the best of all worlds.