

TEACHING

CURRICULUM DEVELOPMENT AND DESIGN

My research background and training influence the way I teach my courses. With experience applying mathematical tools to problems in fields ranging from fluid dynamics to mathematical biology, I enjoy adding breadth to my students' education. I am able to show students not only the beautiful mathematical theory but also how that theory can be applied to problems in other disciplines.

- **Biomathematics course.** Starting in 2006, I have designed and taught a mathematical modeling course for biology majors (as a section of MTH 175 Applied Calculus called MTH 175 BioMath) that is a blend of calculus and statistics. Unlike a traditional calculus course for the life sciences, the goals for the students are to use mathematical and statistical tools to 1) model a variety of biological systems; 2) better assess biological inferences; and 3) analyze data from experiments drawing sound conclusions about the underlying processes.

BioMath is a new course at the beginning of a developing curriculum in mathematical biology.

- In 2005-2007, I solicited a discussion on the content of the BioMath course from individual biology faculty and the entire department during a department meeting.
 - In January 2006 and 2007, I attended the session **Integrating Mathematics and Biology in Undergraduate Education** at the American Mathematical Society (AMS) - Mathematical Association of America (MAA) Joint Mathematics meetings. Many of the presenters stressed that biology examples in a biomathematics course should be as realistic as possible. Influenced by their message, I address the course goals of MTH 175 BioMath by frequently having the class take the perspective of a biologist trying to set up a mathematical model based upon experimental observations. Students are frequently asked to analyze data, provided in part by our biology faculty, using the methods discussed in class.
 - This fall, with the support of the **Wisconsin Teaching Fellowship**, I created a set of pre/post surveys to measure students' connections of biological scenarios with the graphs of elementary functions.
 - On September 24, 2007 my abstract "BioMath I: Getting Biology students prepared for a course in mathematical biology" was accepted for presentation at the MAA session **Biomathematics in the Undergraduate Curriculum** at the AMS-MAA Joint Mathematics Meetings in January 2008.
- On April 4th, 2007 Dr. Roger Haro (of the biology department), Dr. Bruce Riley (of the mathematics department), and I authored a proposal titled **Collaborations on Riverine Ecology (CORE)** to the National Science Foundation Grant on Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences. The program would support 6 student teams consisting of both math and biology majors for a year and half research, learning, and mentoring experience. The grant received positive reviews, however only 8 of the submitted 34 proposals were funded. We still think we have a good idea and we are presently looking for alternative funding sources.

My strongest quality as a teacher is simply my passion for mathematics, which I believe is contagious. I bring in applications (my favorite facet of mathematics) relevant to the course content; I take pauses in the lecture to interject short historical accounts of the mathematicians who discovered the material; and I continually remind students that I am willing to spend extra time working with them. I believe that this commitment and attitude inspires my students to put more effort into the course.

An effective instructor is also a learner. I am a 2005-2006 **Project New Experiences in Teaching(NExT) fellow**. Project NExT is a national professional development program for select (currently a 66% acceptance rate) new or recent Ph.D.s in the mathematical sciences. Fellows attend and organize workshops concerning teaching and scholarship at three national math conferences and remain connected through an email discussion list.

- In September 2006, I participated in the **Project NExT-Wisconsin** workshop on “Engaging mathematics, for our students and for us.” and in the May 2006 I attend a workshop at University of Wisconsin System **Faculty College** on “Aligning student learning with course objectives.” Both those workshops emphasized that writing projects are important learning tools. In my upper-division math courses (MTH 207, 208, 353, and 480), I require multiple **writing assignments**. As with any discipline, students need to practice communicating their work to others. I firmly believe that the act of writing mathematics can enhance student learning. The depth of understanding required to produce a lucid mathematical explanation is generally deeper than that demanded by traditional homework assignments. As students write their solutions, and therefore as they discover how much harder it is to explain than merely to solve the problem, they deepen their own understanding of the mathematics underlying their solution. Finally, projects are by their very nature open-ended and therefore difficult, demanding that students develop and practice the problem-solving skills that are the hallmark of mathematics.
- In October 2005, I submitted a proposal to the *Faculty Development Committee*. The budget was fully funded and included support for travel to the Project NExT workshop in Knoxville, TN. I participated in a session on “**Teaching the Sophomore Level Differential Equations Course in the 21st Century (not the 19th)**” that provided a collection of innovative visual approaches. Now when I teach **MTH 353** Differential Equations, I discuss each major topic from three viewpoints: theoretic (when do solutions exist), analytic (what are the solutions), and geometric (what do the solutions look like). The three approaches prompts a classroom discussion on the differences between a solution formula, a graphical solution, and a numerical approximation. Since the teaching method from this workshop accommodates different learning styles, I have adapted it to the calculus course I am currently teaching (**MTH 208**).
- From September 2005 to March 2006, I was a member of a UW-L workshop on creating a teaching portfolio. My final portfolio was displayed as an example on the **UW-L Center for Advancement of Teaching & Learning website**.

ADVISING UNDERGRADUATE RESEARCH.

Undergraduate research is an important opportunity for students to delve deeper into the beauty of mathematics. Guided research projects require students to apply knowledge learnt in a structured classroom to a particular problem modeling a real life situation or phenomena. In August 2005, I attended “**Undergraduate Research – How to Make it Work**” at the national MAA MathFest meeting. The workshop addressed the means of finding problems appropriate for undergraduates, methods of helping them succeed in their research, and ways the students can present their final results. The workshop directly effected my approach to mentoring undergraduate students.

- During the summer of 2005, I advised a math major, Devin Bickner, on an undergraduate research project. Since Devin was a music minor I asked him to find an equation that predicts the motion of a plucked guitar string. He proposed a model that included the realistic effects of dampening expected from a guitar string. Devin solved the equation, applied it a low E-string, and used mathematical software to “pluck the string” and hear the solution. Devin presented his work at the **Pi Mu Epsilon Conference** at St. Norbert College in November 2005 and is continuing his study of mathematics in a Ph.D. program at Iowa State University.
- Starting in the fall of 2007, Trevor Hallock is studying how techniques in applied mathematics are used to describe the fluid motion of a line with strong rotation. The project is an unknown result related to one of my research projects. In October 2007, Trevor submitted a proposal to the **Undergraduate Research Committee** for funding.

APPROACH TO GRADING AND EVALUATION

I strongly believe that students need constant encouragement to be reflective learners. Although their grade is calculated based upon on their homework (via weekly quizzes), exams, and written projects, I remind them that focusing on connecting the concepts is the surest method of succeeding the course. Students assess their understanding of the concepts by applying them to the assigned homework problems.

I begin every class soliciting questions on the homework. When talking about homework problems, I always keep three things in mind: I involve the whole class in thinking about or addressing the problem; I emphasize the progress that the question-asker has already made on the problem; and I use their feedback to guide them in the correct direction. I try not to finish the problem for them, since that is their reward for the invested time.

The questions on the exam are often similar to examples discussed in class or to the homework problems that I assign. However, I make a habit of always including one or two questions that require students to extrapolate from concepts we have covered in class. On the day I return the exams, I spend time discussing the solutions and addressing common mistakes. I encourage my students to find their own mistakes and correct them, continually emphasizing that the material before the test is still relevant and will be needed throughout the course.

On writing projects, the students are assessed not only on the mathematical content of their solutions, but also the clarity and correctness of their writing. The students are given criteria defining the expectations I have for their writing and a copy of the grading rubric.