TEACHING STATEMENT

JOE J PEREZ

1. Experience

I am currently in my second semester as Visiting Assistant Professor of Mathematics at Texas A & M University–Kingsville. Prior to that, I taught for five years in the math department at Stonehill College. In addition, I taught throughout graduate school at Northeastern, Tulane, and Texas A & M University at Kingsville and College Station. This amounts to more than fifteen years of experience teaching math across the undergraduate curriculum. I also have significant experience teaching physics; at Stonehill, I co-taught undergraduate classical wave theory and quantum mechanics, and as a graduate student, I taught several laboratory courses and recitation sections in physics courses. Since starting at Kingsville, I have served on one master's thesis committee for mathematical physics and am serving on another in pure math. One of my recommenders, Louis Thurston, heads both of these committees. At Stonehill, I also co-advised a senior thesis in computer science.

2. Teaching Method

In Kingsville and at Stonehill I have encountered classes in which there was a wide range of preparation among the students. Some were going into secondary education, some into engineering, while others intended to go on to graduate school in math or the sciences. To address this, I strive to present courses sufficiently complete and demanding to prepare students for graduate school in mathematics or in related fields. I believe that all students benefit from exposure to the full gamut of ideas in a course, even if a few move on with only a casual acquaintance with some of the material. In order to provide a meaningful and enriching experience for every student, while not limiting those with the most aptitude and interest in the subject, I actively seek out and encourage the most interested students to engage in individual mentored projects which pursue the course material – and its implications, extensions, and foundations – in greater depth. I have accumulated a large collection of projects (primarily in Maple and Mathematica, but also some involving more theoretical work) to assign these more engaged students. Some examples can be seen at http://www.joejperez.com/Teaching.html. To further encourage the very best students, I have offered assistantships and directed study courses as opportunities for additional mentoring and advising. In this way, I have attracted several spectacular students to math and physics and guided them toward graduate school.

I also actively seek out students who appear to need additional assistance, and encourage them to come to office hours, or arrange help sessions, where I work problems and examples with them on an individual basis. One scheme that I started using in Kingsville, and which worked particularly well, was to attract students to problem sessions with offers of free coffee. Meeting outside class also gives students opportunities to critique lectures and suggest clarifications of imperfectly presented material later. This combination of a rigorous

syllabus tempered by a willingness to help and adjust seems to me a good way to give a complete course while keeping all students engaged in the discussion.

Teaching is a learning process for both the teacher and the student. I have participated in several professional development programs. For example, at Stonehill, I attended Faculty Development Days, and at Tulane, I had some of my lectures were videotaped and critiqued. In addition, I frequently ask students in lecture about their level of understanding, and modify explanations, or provide review of material. To date, I have had positive teaching evaluations and strong enrollments. Evaluations from students at Stonehill are available at http://www.joejperez.com/students.html.

3. Interdisciplinarity and Course Development

My background in Applied Mathematics is rich and varied. I hold a BA in Physics and have done some graduate work in Physics, concentrating in Quantum Field Theory (QFT). During that period I held a research assistantship in experimental atomic physics. Wanting to understand QFT at a more rigorous level, I changed my course of study to mathematics, while continuing my studies in more heuristic techniques in a full-year graduate course in applied math. The course was taught from the books by Bender & Orszag and Cole & Kevorkian, with particular emphasis on boundary-layer behavior of PDE and multiscale analysis. I passed the corresponding qualifiers in applied mathematics at Tulane.

One way to explain material in a relevant way is to adapt it to the interests and courses of study of my students, which leads naturally to the idea of interdisciplinarity and applications. In particular, when a math department's role in a university is largely service, it must hold its relevance by frequently demonstrating its value to those it trains. I have tried to do this by teaching strong, useful, applied mathematics alongside related theoretical and abstract concepts. I believe that emphasizing the commonality between other disciplines and math is a central aim for a math department and one to which my background and experience are particularly well-suited.

The Mathematical Association of America's Committee on the Undergraduate Program in Mathematics (CUPM), which sets goals for undergraduate mathematics education, also attaches much importance to interdisciplinarity. While at Stonehill, I contributed to several initiatives consistent with these goals. For example, I collaborated in designing and teaching a highly successful Learning Community in Classical and Quantum Wave Mechanics with the Department of Physics. These courses linked the multivariate calculus-differential equations sequence with wave mechanics. My collaborator in this project, Alessandro Massarotti, is one of my recommenders. Since at Kingsville, I have initiated talks with the Chemistry Department, with the goal of creating a course linking Physical Chemistry to the same two math courses.

Also while at Stonehill, in consultation with colleagues of the Physics Department and administration, I integrated physical applications into my courses in PDE and Numerical Analysis, to the extent that these courses were accepted for credit toward the physics degree. As these courses have a large component of programming in Maple, students acquire familiarity with programming, computer algebra systems, visualization software, and statistical software, in accordance with CUPM goals. Also, while at Northeastern, I taught Finite Math for math and computer science majors and used its sections on induction and proof as a short version of a logic course.

4. Undergraduate Research

As my research is in partial differential equations, intuitive and approximate approaches and physical models suggest ways of solving problems, and are a source of conjectures. Additionally, they serve as a way to connect my research to investigations that an undergraduate or beginning graduate student could perform numerically, or analytically, with Maple or Mathematica. For example, I am currently performing numerical investigations into a property from my research that I call amenability. Any undergraduate in the sciences or engineering would understand the question and be able to participate in its solution.

At Kingsville, I was a mentor for the NSF Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP). My student expressed an interest in learning mathematical tools useful to his future studies in aerospace engineering, so I specifically tailored his project to PDE and fluid flow problems, and their numerical solution and visualization. Some animations are posted at http://joejperez.com/Teaching.html#step.

Below are some descriptions of recent projects that would be suitable for continuation as an undergraduate research project:

(1) Computational algebra, graphics, http://www.math.cornell.edu/~hatcher/SO/SO.html
(2) Triangulations, statistics, and topology, http://joejperez.com/Math/triangles.html
(3) Image processing of electron micrographs of virions, http://joejperez.com/Math.html#virus

I am excellently equipped to teach many disparate disciplines centering on mathematics. As a teacher, I have found in nearly fifteen years' experience the importance of bringing humor and camaraderie to the classroom while maintaining a rigorous course outline. I have enjoyed the collegial atmospheres at Kingsville and Stonehill and my previous postings, and have maintained productive relationships with colleagues and professors of mine throughout my career.

You learn math with your hands, not your mind. – I.M. Gel'fand

References

[1] Bender, C. & Orszag, S.: *Advanced Mathematical Methods for Scientists and Engineers: Asymptotic Methods and Perturbation Theory*, Springer, New York, 1999
[2] Cole, J. & Kevorkian, J.: *Perturbation Methods in Applied Mathematics*, Springer-Verlag, Berlin, 1981
[3] CUPM site http://www.maa.org/cupm/
[4] Finite Math http://www.math.neu.edu/undergrad/ugcatalog.html#230
[5] Learning Community Proposal http://www.joejperez.com/TeachingPortfolio/LC.pdf
[6] Math page http://www.joejperez.com/Math.html
[7] Teaching http://www.joejperez.com/Teaching.html

October 21, 2008