Teaching Statement

Since I began teaching in the autumn of 1999, I've taught a variety of classes ranging in topic and level of complexity. As a graduate student instructor I was solely responsible for several courses. My post-doctorial teaching has given me experience at a variety of levels, including advanced undergraduate courses as well as a graduate topics course. The practical details of my teaching process has varied considerably between different classes, yet my underlying principle is uniform. I believe the role of instruction is to first provide the framework, vocabulary, and opportunity to communicate ideas, then to promote the confidence to do so. A student truly understands a concept when they can explain it to someone else.

Material taught in mathematics classes can traditionally be divided into broad categories; concept, technique and application. There is an unfortunate tendency among many students to focus on the last two. This is understandable; most mathematical ideas are surprisingly subtle when first encountered. After all, it took mathematicians centuries to develop most of the theory encountered in university level mathematics. It is unreasonable to expect a student to reproduce this, but it should be emphasized that this abstract theory is vital to a true understanding of the practical uses of mathematics . The key ideas should be introduced through lecture or independent reading and instructor led discussion. Once the basic framework and vocabulary has been established, students should be then be guided through the independent development of applications and mathematical techniques from the basic theory.

The implementation of this philosophy depends heavily on the structure of the class and the goals of the course. I approach a small class in differential geometry or linear algebra geared for math majors very differently than a large calculus class or smaller courses aimed at applied science. Small courses, where individual attention can be given, are much more flexible. When the focus is purely on the mathematics, it is ideal when a modified Moore method can be employed. Regular lectures would be dispensed with and the students would develop the material themselves from the definitions through homework or group work exercises. The class meeting time can then be used for one on one meetings or oral presentations of solved problems and group discussion. I employed this method in portions of the geometry courses I previously taught, however many aspects of differential geometry were too technical in nature for this approach. A formal lecture style was more effective in developing the theory to the point where the students could independently explore its details. In the future, I am interested in developing this methodology for smaller courses in topics such as axiomatic geometry, topology and linear algebra.

When the focus of the class is more applied, such as in the typical differential equations course, I've found a different approach more useful. Typically I use a lecture approach to develop theory and basic techniques or to demonstrate the use of computer software. Students are then expected to work together in using the provided resources to study applications of increasing sophistication. The software involved has ranged from simple applets to draw direction fields and phase-plane diagrams, to using Maple to explore properties of wave equations.

For lower level classes, such as most calculus sequences, I find that many students require more focused guidance and supervision. Once the concepts are introduced, usually via a lecture format, the students should be led through structured exercises in groups to illustrate the ideas, develop technique and study application. This process does require a fair amount of contact between the instructor and individuals. In larger classes, this may not be possible during lecture periods and should be implemented through the use of teaching assistants when the class is broken into smaller groups. For example, when the students first encounter the theory of integration, a lecture first introduces the idea of the definite integral as a Riemann sum. Simple examples of finding the areas are discussed with the class as a whole. Next the students are led through group work exercises on solids of revolution or work problems. The exercises are structured to first suggest to the students how to break the problem apart into easily solved chunks. It is then that they are prompted to apply the theory of the definite integral and Riemann sums to solve the problem as a whole. Ideally the students should be able to take pride in having discovered something for themselves.

After the students have had time to grapple with the material, I run through several more complicated examples, chosen either by myself to illuminate any subtle points arising in the process or by the students themselves. It is advantageous that I do not always pre-prepare all the solutions. My experience has shown it is important to not always present polished arguments. The students benefit from seeing the thought process involved in constructing a solution from scratch. It comes as a surprise to many students that they are supposed to find some problems difficult; the solution is not always obvious, even to the instructor. This realization can boost the confidence many students. To further this point, I'll ask students to suggest methods of approach. When a suggestion is reasonable, I'll run through it even if I know it's doomed to failure. Sometimes I even suggest such methods myself in order to express the importance of experimenting and learning from mistakes.

The level of confidence varies enormously from student to student. It is vital that the students feel they are free to approach me at any time in person or by e-mail with questions. I strive to be patient and prompt with responses. A large portion of my time spent with students often involves persuading them that they understand far more than they believe they are capable. It is important that my students know what is expected of them and where they stand. I do not see a problem with setting difficult tests provided the students are made aware that I realize it is difficult and that this will be taken into account when assigning grades. When possible I like to set exams which give an opportunity to demonstrate the positives of what has been learned, rather negatively penalizing for what has not. One way I have found effective is to split my final exams into two sections. The first tests the understanding of the key material with straightforward problems. The second will contain several more challenging questions from which they have to choose one or two. Thus, the student has an opportunity to demonstrate a strong understanding of a favorite topic. Also, I firmly believe in testing comprehension rather than memorization. It is more important that the students have the ability to apply information than reproduce it. Commonly, I structure exams around the students being allowed notes or their text. My questions are constructed to test how well the material is understood, not whether the basic facts have been memorized.

As computer based and online tools become increasing sophisticated and available, it is becoming more and more useful to incorporate these tools into the class structure. Online software such as WebWork now provide an excellent tool for evaluating students, particularly in large calculus classes where the program can supplant most written homework. The instructor and teaching assistants then have more time for direct face to face communication with students. Moreover, the students receive regular, instant feedback on their work. If a student does not understand an integration technique, they will know immediately, not a week or two later after the homework has been returned and the class has moved on. In advanced classes, such programs are useful as a supplement to written homework. I've been using WebWork in classes for over 4 years and would enthusiastically continue to do so. My experience also provides me with the knowledge to assist in developing the infrastructure to implement such a system.

Above all else, I work to keep my classes enjoyable and practical. I find my enthusiasm is key to keeping students actively interested and participatory. A course is a success when everyone comes to class looking forward to learning.

Teaching Experience:

University of Rochester: Visiting Assistant Professor (Semesters)		
(235) Linear Algebra (theory)	Fall 08	Moodle, WeBWork
(165) Linear Algebra and Differential Equations	Fall 08	WeBWork
(256) Differential Geometry II	Spring 08	
(143) Calculus III	Spring 08	WeBWork
(255) Differential Geometry I	Fall 07	WeBWork
(140A) Precalculus	Fall 07	WeBWork
(164) Multivariable Calculus	Spring 07	WeBWork
(161) Calculus 1	Spring 07	WeBWork
(162Q) Calculus 2 (Quest)	Fall 06	WeBWork
(142) Calculus 2	Fall 06	WeBWork
Webpages of current courses linked at www.math.rochester.edu/people/faculty/hladky/ Course catalog available at www.math.rochester.edu/courses/		

Dartmouth College: JWY Research Instructor (Quarters)		
(33) Mathematics in science and engineering	Spring 06	Maple
(15.2) Mathematics for the physical sciences	Winter 06	
(42) Geometry of curves and surfaces	Winter 06	Maple
(9) Calculus of one and several variables (Honors) (8) Calculus of one and several variables	Fall 05 Spring 05	WeBWork WeBWork
(102) Introduction to complex manifolds	Winter 05	Graduate topics course
(8) Calculus of one and several variables	Winter 05	WeBWork
(23) Differential equations	Fall ’04	

University of Washington: Graduate Student Instructor (Quarters)		
(307) Differential Equations	Spring 04	
(444, 445) Geometry for high school teachers 1&2	Summer 02	Part of a team of instructors
(324) Advanced multivariable calculus	Summer ’01 Fall 01	
(126) Calculus with Analytic Geometry 3	Spring 03 Spring 01	
(125) Calculus with Analytic Geometry 2	Winter 01	

University of Washington: Teaching Assistant		
(125, 128) Calculus with Analytic Geometry 2 (126, 129)Calculus with Analytic Geometry 3	Various	Honors and non-honors