As a graduate student I received the David A. Rothrock Teaching award from the Department of Mathematics at Indiana University. In 2009 I received the Westfall Scholar Mentor award for being the teacher who inspired one of the best undergraduate students in the College of Science at the University of Nevada Reno. I currently teach honors calculus for the UNR honors program. I have also supervised one undergraduate honor's thesis. In addition to my work with the honors program I have developed and revitalized graduate level courses in numerical analysis, partial differential equations and Fourier and wavelet analysis. I have written and graded qualifying exams for Real Analysis, Numerical Analysis and Methods of Applied Mathematics. I have supervised four master's thesis three of which have resulted in publishable research. Helping students individually in my office is something I enjoy. When a student of any level stops by, I almost always have time to discuss mathematics.

General Philosophy

My teaching focuses on developing the following skills:

1. Solving difficult homework problems and writing them up clearly.
2. Instant recall of definitions, statements of theorems and important proofs.
3. Solving simple problems on quizzes and exams under time constraints.

These three skills are just as important for freshman calculus as they are for graduate level course from real analysis to methods of applied mathematics. While different skills come more naturally to different students, I have found that all students respond to my expectations and exhibit ability in all three areas. These three skills are valuable for future mathematical work but are also applicable to other careers and fields of study.

Since 2001 I have written short summaries of each course I taught reflecting on what was accomplished and what I would do next time. This teaching portfolio is now over 50 pages and documents my continuing development as a teacher. The following sections illustrate some of my teaching experiences.

Honor's Calculus

Six years ago I was asked to teach a special section of calculus for students enrolled in the UNR Honors College. Prior to my involvement, the course was simply a section of regular calculus reserved for students in the honors college. My job was to upgrade the course so that it satisfied the guidelines for an honors course. In particular, honor's calculus was supposed to cover the subject at a greater depth while at the same time not being more difficult than the regular calculus course. I enjoy teaching the honors calculus course.

Unlike advanced freshman courses intended for mathematics majors, Honors Calculus is intended for all students in the honor's college. These students have diverse interests ranging from engineering, science and medicine to music, English, history and other non-mathematical fields. In creating this course I have used many different textbooks and my own notes along with a careful system of quizzes and homeworks. No matter what their career goals I have found that my students are able to learn both theory and applications. The first semester focuses in depth on theory and proof; the second semester focuses on applications and the use of computer algebra systems.

First semester begins with the ϵ-δ definition of limit. I stress how a new concept such as limit can be defined in terms of an existing concept such as a system of inequalities. By the end of the first semester the students are able to use the definitions to prove the limit laws, mean value theorems and fundamental theorems of calculus. In addition they have reviewed trigonometry, learned induction, geometric series and other explicit sum formula. They have also mastered the use of differentiation rules to find derivatives.

Appropriate use of computer technology is very important in teaching. Most students already know that calculators multiply and divide better than people and that computers can solve derivative and integral problems better. As a result some students question whether there is any point in doing any calculation by hand. After I explain that the integral problems on the homework were designed teach the theory, transformation rules and algorithms that are part of calculus, they understand why it is important to work those problems by hand.

During the second semester we use calculators as well as the Maple computer algebra system. The class meets once a week in the computer lab. Half of our exams are in the computer lab while the other half are traditional quizzes in which no calculators are allowed. By the end of the semester, students are familiar enough with Maple to perform multiple step calculations using the worksheet interface with intermediate variables and functions. They have also learned to how to write for loops and visualize surfaces using the three dimensional plotting commands.

Master Theses

I have supervised a thesis for four master's students: Kevin Hayden, Chris Wingard, Xander Henderson and Masakazu Gesho. I enjoyed supervising each of these students. While our department doesn't offer a Ph.D. degree, I believe three of these projects could easily have been developed into a Ph.D. level dissertation.

After graduating Kevin spent a year working at the California Institute of Technology Jet Propulsion Laboratory and then spent two years teaching at the University of Arizona Flagstaff. During this time Kevin and I along with Edriss Titi published a paper in *Physica D* based on results in his thesis. Currently Kevin is serving as an officer and helicopter pilot in the United States Army. Chris began a Ph.D. at Michigan State University after graduating. He is currently a lecturer at The Ohio State University. Xander Henderson defended his thesis last year and is currently applying to Ph.D. programs. He and I are in the process of writing a paper that further develops results in his thesis as a joint work with Jonathan Fraser and James Robinson. Masakazu Gesho defended his thesis last year. For his thesis he wrote an parallel optimized CUDA GPU code and performed a number of numerical experiments testing a new data assimilation algorithm. After graduating he obtained research assistantship in the Ph.D. program at the University of Wyoming. Numerical computations from his thesis were included as background to a recent NSF proposal submitted by myself joint with Hakima Bessaih, Aseel Farhat and Mike Jolly. These computations are currently being extended and prepared for publication.

I have also assisted with advising Hisham Nada, Onur Dur and Quan Zou on their master's thesis. Hisham's thesis involved an earthquake analysis of the architectural flares on California highway bridges, Onur computed the effects of airfoil design on reducing the deposition of snow on the taillights of snowplows and Quan showed that a neural network originally designed for hand-eye coordination in robotic control also possessed a type of short term memory.

While supervising a thesis I like to meet once a week with a student to work together in my office. This is how my advisor helped me. I believe regular meetings help to ensure progress even when there are no new results to report between meetings. Working together also helps a student see how a more experienced researcher would approach a problem. I enjoy this time, important progress often occurs right in my office and by the end of the thesis each student has started working and proving results on their own.

Mastery Approach to Teaching

I feel mastery based learning is natural in mathematics because understanding a new topic in mathematics is dependent on having mastered old ones. In 1986 as an undergraduate I wrote computer software to assist in the mastery based teaching of a course in analytical chemistry. In 1996 as part of the teacher mentoring program at Indiana University, I adapted this software to generate individualized problem sets for business calculus that each student could work using a form based web interface for immediate grading and feedback. In 2003 I again taught business calculus at Indiana University using a computer assisted mastery based approach. This time I used a database that Dr Wheeler had already set for the Webworks homework system at the university that any instructor could use. Summer 2011 I used the commercial software MyMathLab by Pearson that integrates into the calculus textbook by Hass, Weir and Thomas.

I have experience at setting up and running online homework systems as well as experience teaching courses that use such systems. As with any technology, a computer based homework system can have positive effects if used properly and negative effects if not. There is much more to learn than getting the right answer. This is why I also emphasize the correct format and layout of a pencil and paper calculation as well as what theory the calculation illustrates.

Problem Solving Approach

Another teaching method I use is the problem solving approach. Students are formed into small groups and then asked to think about certain problems on their own. A lot of care must be taken to choose appropriate level questions and to keep each group moving forward. I assisted with a statistics course taught in this way at Indiana University. Later, I used this method to teach Mathematics for Elementary School Teachers. The projects I have developed for my numerical analysis courses employ the problem solving approach to learning. I also find the problem solving approach effective when teaching honors calculus.

Numerical Analysis

When I first came to UNR I was asked to teach numerical analysis. At that time numerical analysis was offered once a year in a combined section of undergraduate and graduate students. As a result of my efforts and those of other faculty members, UNR now offers a two semester course sequence in numerical methods that runs every year as well as an advanced 700 level graduate course sequence that runs alternate years.

When I teach numerical analysis I choose a careful path between derivations, theoretical understanding and practical scientific programming. In addition to pencil and paper homework and short numerical experiments, I have constructed a number of projects that combine programming with theory. These projects include open ended theoretical questions as well as questions focused on coding style and efficiency. The widespread availability of multi-core CPU and GPU systems has increased interest in parallel algorithms.

A trend that has been remarked on by others is that current university students are less likely to be familiar with computer programming than in the past. When I taught the graduate level numerical analysis class last year roughly half the students had difficulty reading and writing computer programs. To counter this computer illiteracy I held a series of optional programming workshops on the weekend in the computer lab. I wanted the students to learn scientific programing in a Linux/Unix POSIX environment, but the computers in the lab were running Windows 7 secured with a wide selection of well known applications but no programming tools. We got around this by setting up a boot server for the class that allowed us to temporarily boot a diskless Linux image onto any computer in the lab without disrupting the Windows 7 installation. It worked amazingly well.

Each Saturday we spent two hours in the lab getting hands-on experience using makefiles, C programming, Intel C-ilk parallel programming, LAPACK, LaTeX and plotting with Gnuplot. We also used computer algebra systems to automatically generate optimized C subroutines and discussed efficient use of the hardware memory cache. These optional workshops were well attended by students in the class and even by a few not in the class. Students learned how to create a LaTeX project report with automatically updated program listings, output and graphs. Students made animated graphs. Most importantly, students became computer literate reading and writing programs in the software environment used on workstations to supercomputers for almost all scientific computing. It was fun and I look forward to doing it again next time I teach numerical analysis.

When I last taught the graduate numerical analysis course I assigned a project on the numerical solution of the non-linear Schrödinger equation. One of the former students of that class gave a talk at the October 2013 Southeastern Sectional Meeting of the American Mathematical Society presenting their work on a new numerical scheme for this equation. Numerical analysis is a huge field that combines software engineering with many types of mathematical analysis to treat a variety of problems. I find these courses to be new and exciting each time I teach them.