

Statement of Teaching Philosophy

Xiang Wan

“Xiang communicates his teaching points very well, especially through a wide array of examples, both simple and complex.”
— a student in Applied Calculus I, Fall 2012

“He always tried to relate subject material to real-world applications, and it was good for us to understand the importance of how calculus is used outside of classroom... make me want to learn more mathematics.”
— Calculus II, Fall 2013

“I think you were very fair, not too harsh but not too easy on us.”
— Calculus II, Spring 2014

“You have been chosen for this honor (GTA teaching mentor) because of your demonstrated excellence in the classroom.”
—Paul Bourdon, Director of Lower Division Courses, Department of Math, University of Virginia

The opportunities to teach and work with students during the graduate school years, as well as the experience of being a student myself for many more years, have helped me establishing several tenets of teaching. These tenets have led me to the honor of being a *GTA teaching mentor*, as well as to the opportunity to teach Calculus III in the forthcoming Spring of my fifth year, a course that normally could only be taught by faculty members and selected graduate students at least in their sixth year. These tenets were tested on students from various courses with different backgrounds and objectives during my eleven semesters as an Instructor, five semesters as a Teaching Assistant, and multiple times as a Visiting Teacher to local elementary and middle schools through the Teaching Outreach Program. They continuously shape my philosophy of teaching and influence my actions as a teacher, both inside and outside of the classroom. They helped me to improve my student evaluation rates from somewhere lightly below the average at the beginning of my graduate school, to one of the highest scores that are *significantly higher* than the mean of all math courses at UVa in recent years.

- Teaching mathematics is like telling stories, and examples are the **best** language.

As a mathematician in PDEs, I was intrigued by research primarily because of how math answers questions which arise from the real world. Consequently, I found it very natural to introduce concepts in Calculus courses by explaining their origins and applications in STEM fields, often via some anecdotes which were very helpful on motivating students' attention and interest. For instance, in Calculus I, most students understand the uniform motion; however they would realize the lack of tools to figure out the momentary speedometer indicator of a car in non-uniform motion, and were excited to learn the fact that Newton and Leibniz solved this problem more than three hundreds years ago! In Calculus III, I often brought up the famous Navier-Stokes equations. I've had lots of puzzles, doubts, and discussions centered on the fact that we actually can not prove whether water would spontaneously blow up. Even this semester I got an email from one of my former students in Calculus III explaining how our discussion led him to learn Fluid Mechanics at the School of Engineering and how excited he is now to know more and more about it. Other examples include the L'Hôpital's Rule with the famous story between Bernoulli and L'Hôpital about money and politics; computing the area of a disk through the efforts made by ancient Egyptian, Greek, Chinese, Babylonian, Indian, and Persian mathematicians on evaluating π ; Taylor series and the connection with Euler's identity and its mathematical beauty.

Examples serve more than just motivations. An abundant choices of good examples are the best media to illustrate the mathematical ideas behind formulas and theorems. Over the years, I kept the style of opening each of my lectures by a “small talk”, a 3-minute introduction on the main topic of

the day, followed by an open question, which was often my very last class example. In this way, each lecture (sometimes two) was constructed as a small project. The text and math symbols they copied from the blackboard into their notebooks are not just something they only witnessed, but new items in their arsenal to solve the ultimate “open problem” of the day. Meanwhile, a series of examples will be presented to build up to the final one to demonstrate how to break down a complicated problem into relatively simple pieces. Through this way, I managed to have most students follow closely as the lecture went on, and have them feel accomplishing a meaningful mission afterwards. It was very rewarding to see the enthusiasm from them, and enthusiasm is contagious.

- A good classroom atmosphere is the **key** of a successful semester of teaching/learning.

I strongly believe that classrooms can offer a unique experience of learning, which cannot be offered by online course videos or class notes alone. In particular, it is the interaction between instructor and students that has the significance and makes the difference. A good instructor should endeavor to have the class full of questions from both sides of the rostrum, and lead the students to find the answer themselves, especially to answer questions from their fellow classmates. Not only will this leave a strong impression to the students of what they learn, but also it offers the instructor a great chance to assess the class. A wrong answer from a student sometimes would provide even more information than a correct one. It could be a sign of certain common weak point on previous materials, or an indicator of a wide misunderstanding on the new section. These are very valuable feedback for adjusting progress.

In order to keep students’ participation, I devote great efforts from the very beginning of each semester to set up a fair, active, and fulfilling classroom atmosphere, and this is not trivial at all! It is very common to see that students feel “stupid” to ask questions at the beginning, which often leads to an awkward silence. One of my solutions is to take two weeks to remember all students’ names (with a class size of 45), and after that I will call everyone by his/her own name. In this way students will feel uniquely identified and normally will be more willing to speak. Another important approach is to identify their backgrounds in the very first lecture by a quiz, and then assign questions targeted to suitable students. After a week or two of several successful attempts, the most unconfident student will start to speak voluntarily, which will begin a virtuous circle for every participant.

- Being a **fair** teacher is as important as being a good teacher.

Besides the methodologies I did and didn’t have the chance to specify above, I value the fairness very highly, both as a student and as an instructor. One of the greatest things this nation teaches us is that we are equal in the sense that we need to earn what we have, and we will have what we earn. I surely delivered, and will keep delivering this value very clearly to my classes. For instance, I don’t deny that students with strong background will leave a strong impression on me at the beginning; however that doesn’t mean I would be even a bit less enthusiastic on teaching a weaker student. As long as a student is willing to learn, I will still try my best to offer all I can do for his or her success in my class. There have been countless examples of my previous students who started classes with somewhat lower performance; but after great efforts of a full semester, he or she ended up with a very satisfactory grade. Even for those students who are not that driven to work, I offered help whenever needed, even in the last minutes of the class. After every semester, when I have access to the students’ comments on me, the word I want to see the most is “fair”. Fortunately, I’ve seen it all the time¹.

In the future I might have the privilege to teach some more advanced courses, or even graduate courses, as well as to design some new courses. Also in the forthcoming Spring I will be independently mentoring an undergraduate student for a joint project. These missions will surely put new challenges on my teaching. Meanwhile, thanks to those tenets mentioned above, I am well prepared to take these challenges, and I look forward to the opportunity of joining a research university to become a better teacher and a member of the mathematical community.

¹Selected courses evaluations, statistics, and students’ comments are available at: <http://people.virginia.edu/~xw5he/teaching.html>