

# Teaching Statement of David Nacin

nacin@math.rutgers.edu  
www.math.rutgers.edu/~nacin

My experience as a TA and lecturer has led to my current philosophy of teaching. Let me first describe my teaching experiences.

## Experience

I have many years of experience both as a lecturer and teaching assistant at Rutgers, a large state university with students of diverse backgrounds and learning styles.

I was a teaching assistant for courses such as precalculus, calculus for liberal arts majors, and calculus for mathematics and science majors. Each of these semesters I taught three sections of approximately thirty students each. I led both traditional question and answer style recitations and more interactive workshop meetings.

In these workshops students divided into small groups and discussed problems more challenging than normal homework from the sections they had been working on. I worked together with an undergraduate peer mentor to give suggestions and to encourage participation by all students in each group. At the end of class one of these problems would be assigned. The students were required to write up a formal explanation of how they arrived at their conclusions for the assigned problem. I graded this on both correctness and exposition. The idea is that students learn mathematics through practice, and that one truly understands something when one can explain it to others

After my first year as a teaching assistant, I was rewarded for my performance and outstanding evaluations with the department's TA Teaching Excellence Award.

During each of my summers at Rutgers I have taught a summer session course. In each of these courses I have, as the only instructor, had full responsibility for the class. I wrote lectures, quizzes and exams, chose the homework assignments, held office hours, and did all the grading including the final assignment of grades. For the more standard courses I designed the syllabus to cover the required sections, but for the higher level courses I had even more freedom. I had complete control in choosing the textbook, deciding which sections to cover, and writing the syllabus from scratch. These classes ranged from introductory courses such as calculus and linear algebra, and senior level courses such as number theory, combinatorics, and probability.

This semester, the mathematics department has given me the unusually responsible assignment of teaching the honors cryptology course in place of my usual teaching assistantship. This is an experimental class designed for non-math majors on the honors track here at Rutgers. The idea is that some modern cryptology methods such as RSA and Diffie-Hellman can be taught to students without many prerequisites in mathematics (such as calculus). This course was founded here at Rutgers with help from a National Science Foundation grant.

## Philosophy

Students should learn the methods and concepts of the subject they are studying. I, however, seek to also change the way they view mathematics. I wish to convince them that it is not a subject of memorization but one of exploration. If they can't remember something like the quadratic equation, I think it is good to derive it in front of them and explain the motivation behind each step. Doing something like this only takes a couple of minutes, and it isn't a waste of time since you are reinforcing algebraic manipulations that students need to solve calculus problems. This helps them see that mathematics is something that can be discovered. I wish to make them feel like active explorers with an understanding guide.

In some cases it can be hard to convince students they could have found a formula or shown it to be true. I use these situations as opportunities to emphasize how others slowly discovered these things while working with the body of knowledge of their time. It is with this in mind that I present some of the history of mathematics in each lecture.

I think that most class periods are too long for students to maintain concentration throughout an entire lecture. Thus, particularly near the middle of my lectures, I try to throw my students off balance and surprise them. Quite often this involves humor and deliberately unusual, even silly, actions. It is important to catch students' attention and direct them towards what I'm saying once again. This way I end up getting more across to them by the end of the period. Students are more likely to listen if they are not sure what you are going to say next.

I also use experimental teaching techniques. For example, when I taught number theory the initial sections in the text were about sets, functions and bijections. I filled two bowls with small pieces of chalk and got a volunteer student to come sit down in front of them. Then I turned out the lights in the classroom (which had no windows). The student had to tell me which bowl had more pieces of chalk, or if the two bowls had the same amount. The rest of the class was encouraged to yell out suggestions. They began working out a plan together. The safest plan, they decided, was to take a piece in each hand and toss them aside, then see which bowl (if any) ran out first. They discovered the two bowls had the same amount because they found they could pair the contents together in a one to one fashion. They basically discovered Cantor's definition of cardinality on their own in a ten minute, albeit very dark, class workshop.

I used nonstandard techniques again on the first day of my cryptology course. I came in and wrote my name, e-mail, and office hours on the board; in code. I split the class up into groups of four and had them decipher my contact information. I acted as a coach going from group to group encouraging students to participate in their group. Using tricks like the fact that my e-mail address probably ended in edu all groups succeeded in fifteen minutes. The students understood what it means to crack a substitution cipher by the beginning of the first class and had a lot of fun doing it.

My main hobby outside teaching and research is playing guitar. I think that

being a teacher is not that different from being a musician. The skills required to connect with a crowd and keep their focus and attention are necessary for both professions. I also think that I have developed those skills from both many years of teaching and my experiences as a lead singer.

Another similarity between teaching and music is that the audience can tell whether or not you are having fun. If you've grown sick of your material, either as a teacher or a performer, your audience is going to know. You can't expect them to have enthusiasm for something you don't even enjoy. It is important to relax and think about what you enjoy in the material. Then the fact that you find it entertaining will show, and the students will often concentrate and try and find out what it is that makes it pleasing to you.

I feel that doing a certain amount of foreshadowing helps a class. Before I introduce new concepts, I try to hint at them in earlier lectures. Some ideas simply take more time to get, and students are less afraid of things they've seen a little of before. The foreshadowing also accomplishes another goal. I want the class to know with what aim I'm approaching each new topic. Students get used to just being introduced to tricks so they can repeat them on tests and quizzes. That is what many of them think math is about. Instead, I want the students to see each topic as a step in a direction. When teaching cryptology, I let them know that our aim is public key cryptography. I explain what we might want in a method of encipherment on the first day. Then throughout the class we build up the tools and eventually show that such a method of encryption does exist. When teaching number theory I let the students know that our big ending would be quadratic reciprocity. By giving a little talk about what it means to be a square root early on, I can give the students an idea of what they are aiming for. This gives purpose and meaning to all the theory we develop in the semester. There is always some goal that can be explained early on that can later be worked towards in a purposeful way, such as the law of large numbers in probability or the fundamental theorem of calculus.