Teaching Statement of Maria Angelica Cueto

Since the beginning of my mathematical career I have felt an intense interest about teaching that has evolved to a passionate conviction of its importance for both the students and the teachers. Over time, I began to see the complementary process between teaching and increasing awareness of issues I have been able to apply to my research activities. To encounter fresh minds that often bring an exciting new outlook with doubts and questions, which though often grounded in ignorance of a subject, can shake the routine thinking of even the most hardened teacher.

The diversity of courses at all levels I have taught for pure Math majors and for other scientific disciplines, at the University of Buenos Aires, at UC Berkeley and, most recently, as a postdoc at Columbia University, opened up a perspective on the best way to communicate in each case, and designing befitting exams to test their skills. I learned to establish a dialogue relative to the specific needs and objectives of a non-mathematical discipline. I became sensitive to how the students’ backgrounds structure their thinking in a different manner. The problems to be solved being: how do teachers communicate the mathematical approach to them, and in so doing make them aware of how mathematical concepts can be instrumental to them in the pursuit of their goals. Fundamentally, the teacher needs to remove fears of mathematics as a bête noire by finding ways to strengthen student’s self-confidence. As we learn to profit from mistakes and rise above them, we grow in understanding that what seems an error often becomes the stepping stone to solutions. The sooner we become aware of this, the better.

My teaching philosophy is grounded on two convictions: the first one is that we learn mathematics by doing mathematics; the second one is that we master a topic when we can explain it to another person in short, clear sentences, and illustrate theory by examples. I want my classes to be dynamic, full of inspiring exercises, group work, brainstorming and fruitful discussions. The classroom must have the atmosphere of an interchange of ideas among intelligent people. As such, questions by students are extremely important. As an instructor, I encourage questions from day one. I give both subliminal and explicit reassurances that their questions and confusions are not theirs alone. I always aim to show that a student who asks a question contributes greatly to the discussion, for example, by saying “This is an excellent question because it helps us delimitat the scope and content of the problem at hand Let’s work together to understand what we are trying to achieve.” Paraphrasing my own professors: “If you have a question, your neighbor probably has the same question and will be very pleased if you ask it.” Some students seem a bit reluctant to this approach at the beginning, but after a couple of weeks, they start participating in class and loving it. Part of my role as a teacher is to translate their confusions and struggles into a coherent question and then to answer it. Any wrong question can be turned into a good one, but we should let the students speak in class, not interrupt their train of thought and treat every question with the respect and encouragement it deserves.

Evaluations in homework assignments, quizzes and exams, should always be perceived as fair and equitable by the student. The grading policy and course expectations should be clearly stated to students through an accurate syllabus. Grading is a pedagogical tool: it should help students learn from their mistakes and also serve as a warning sign, substantially marking down those errors that are relevant to the material of the course. For example, an arithmetic error implies a high deduction in a Calculus course, as opposed to a reasoning error on an induction for a Combinatorics class.

An adequate preparation of the lectures is essential for the overall success of a course, and this implies a tailoring of the content and explanations to the characteristics of the students. The ultimate effectiveness of a clear presentation is shaped by the attitude of the instructor. In the eyes of students, mathematics can be a dry, forbidding subject. My task is to motivate each student to learn the material and explain it to his or her peers. To succeed, I carefully pick problems that are challenging for their level but solvable in class, providing bonus exercises for the talented students. I
anticipate questions and possible typical mistakes and misunderstandings, and try to highlight why some approaches to solve a problem work better than others. I also adapt the presentation style to their needs, their mathematical maturity and their learning strategy: some respond better to concrete examples, some to rigorous proofs, whereas other like “proofs by picture.” It is constructive to show all of them in class, both orally and in written form. But, regardless of whether I am leading group work during office hours or giving a blackboard explanation during class, I always let my students guide me through the thought process. Understanding the strengths and limitations of the audience and their academic goals is key to maximizing teaching effectiveness. For example, if I realize that my students do not recall the basic definitions or results of a topic I am about to discuss, it is worth starting with a brief review. Having eye contact with them and monitoring their facial expressions are essential to the success of the class.

I believe lectures should reinforce key concepts. Their main goal is to teach students how to think mathematically. When appropriate, I try to relate the topic of the day to previous concepts given in the course or in prerequisite courses, thinking of the semester as a whole. This helps to reinforce old concepts by revisiting them and to make the new concepts more familiar to the students. By showing them how to translate a new exercise to a question that they already know how to answer, they feel empowered and eager to try homework problems and quizzes without my guidance.

Most of the undergraduates are exceptionally afraid of asking naive questions, or making mistakes in class in front of the instructor. For them, a good course grade is the ultimate goal, and they mistakenly think that showing their doubts in class and in office hours will not help them to achieve this. They feel so pressured by this preconception and by achieving their peers’ approval, that they focus all their efforts incorrectly. I often tell them that a good grade will be a natural consequence of the time and energy they put into their studies, and by asking in class they gain more than by keeping quiet. Errors are nothing to be embarrassed about, and the only dumb question is the one that is not asked. When a person sees a topic for the first time, he/she behave like an ant trying to walk in a two-dimensional world. The ultimate goal of the class is to “gain height” in order to look at specific problems and theory from above, in a three-dimensional world. In this way, we can understand why we follow a certain methodology to solve an exercise, and what motivates definitions and theorems. In short, we see the big picture.

As a postdoc at Columbia University I had the opportunity of teaching three Calculus courses (both univariate and multivariable), each one attended by 100 students. These classes were not complemented by discussion sections, so in my 2:30 weekly hours of lectures I had to present the main concepts of a topic and provide lots of examples and exercises to enable the students to solve their homework. To optimize the learning process during class, I always asked them to help me when providing examples and easy proofs. This presented an unexpected challenge to them, but as the semester progressed, I was very pleased to see that most of them were very engaged with the lectures and suggested examples beyond the textbook. From day one, I encouraged them to try and solve the homework without looking at their notes or the textbook, as a way to enhance and expand the understanding of the lectures. I suggested group work as an excellent opportunity to explore new ideas and consolidate knowledge. Besides the positive outcome of the tests, this showed the students that we master a topic when we can ask questions about it, think of examples and counterexamples with the book closed and can explain the theory to others. After one semester, my students had turned my creed into their own and they had learned a valuable lesson: they discovered a new understanding and enthusiasm for mathematics regardless of their specialization, and they acquired problem-solving skills and good study habits. Up to this class, most of them had never realized their capacity, since they had never been challenged before. I was delighted to see the results of my efforts throughout and at the end of the semester. I look forward to continue helping students in this beautiful path of exciting discoveries and ideas that is mathematics.