

# ANTON GORODETSKI

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## Teaching statement

Teaching mathematics poses a very peculiar challenge. To address this challenge one must master abstract ideas as well as the concrete recipients of these ideas.

Students, unfortunately, often think of math as a mere list of recipes which they need to master and apply in the correct order. Yet mathematics essentially belongs to the humanities. Pure mathematics relates directly to the structure of thinking. The discipline owes its existence to the fact that human ability is limited; our intellect and understanding have some bounds. Among best ways to use our intellect more effectively when trying to comprehend the connections between certain objects is to study these connections outside of the context in which they were originally given. Still better, is to study these connections outside of any context whatsoever. This is the essence of formal reasoning.

The goal of teaching mathematics effectively is to convey this approach to the students by using the models that have been proven effective in solving certain problems.

Ergo understanding multiplication supersedes memorizing multiplication tables. What does this imply for teaching? One must, if possible, approach every lesson with enthusiasm and humility; almost as if one is discovering the material for the first time, full of wonder and a with a healthy sense of mystery. In the classroom a teacher needs to show a thought process to the students, as if proving a theorem for the first time. Even though the result is known beforehand, one needs to witness this process of thinking in order to learn how to think for oneself. In my own experience, I attempt to share with my students not only the information but also the way in which I arrived at the information myself. I take logical steps to reveal the examples that helped me understand the ideas, the questions that came to my mind, and the solutions that were discovered. I find it necessarily useful to share with students my own mistakes and misunderstandings as well as insights.

My educational goals are to provide students with an efficient learning environment and avoid creating an intimidating environment due to the nature of the discipline. The students are not simply solving problems. Instead they are encouraged to participate, ask questions, and engage in a dialog.

The students must perceive the instructor as someone from whom they will learn, discover, and grow and not as someone whose intent is to relentlessly confront them and test their knowledge. Creating such an environment demands the establishment of a set of objective requirements ("rules of the game") that will be explained from the very start. Moreover, the discussion should explain the evaluation criteria, the homework policy, and all other matters relating to the learning environment and administrative concerns. Objective grading criteria facilitates the ability for students to organize their studies.

During my third year as an undergraduate at the Moscow State University my friends and I organized an informal seminar for freshmen. We addressed topics which we had only recently discovered ourselves, sharing the remarkable feeling of

awe and inspiration with our students. As we related every discovery, no matter how small, the enthusiasm we projected yielded an inspirational learning environment.

In 1996, after graduating from Moscow State University, I taught at Bauman Moscow Technical University. Since then teaching has been a major part of my life. As a graduate student at Moscow State University I taught introductory courses on dynamical systems coordinated by Prof. Yu.S. Ilyashenko and mentored the younger students in a Dynamical Systems seminar. Upon defending my theses, I became the official co-coordinator of Dynamical Systems seminar. Between 2000 and 2003 I taught intensively, giving classes at Moscow State University and Moscow Independent University. My primary charge was conducting the scientific seminar and organizing summer schools in dynamical systems. As a result I was given mention in my students' publications to recognize the my contributions postulating problems and providing work assistance. For example,

- Kleptsyn V., An example of non-coincidence of minimal and statistical attractors. *Ergodic Theory Dynam. Systems* vol. 26 (2006), no. 3, pp. 759-768.
- Nalskiy M., Kleptsyn V., Convergence of orbits in random dynamical systems on a circle. *Funct. Anal. Appl.*, vol. 38 (2004), no. 4, pp. 267-282.
- Rabinovich B., Kleptsyn V., Analytic classification of Fuchsian singular points. *Math. Notes* vol. 76 (2004), no. 3-4, pp. 348-357.
- Kleptsyn V., Lyapunov exponents, Attractors and Foliations, PhD theses.

One of these students (a talented and enthusiastic undergraduate who later went on to do graduate studies at Princeton and who is now working at Rice University) even dedicated one of his papers to me, see

- Bufetov A. Topological entropy of free semigroup actions and skew-product transformations. *J. Dynam. Control Systems* 5 (1999), no. 1, pp.137-143.

Currently I am employed at Caltech. I have posted a website for each course where I outline such information as course description and homework assignments. Also, sometimes I assign homework problems that require some basic computer work. This often creates a new dimension for the students, so when they can create Mandelbrot and Julia sets, they begin to see complex dynamics from a whole new angle. Still, I am firmly rooted in the idea that technology will never replace personal interaction with the teacher.

I have lectured to small groups of students as well as groups of over 150 people ranging from future engineers to psychology students to graduate students in mathematics. I've had the pleasure to work with incredibly talented students (some of whom are now teaching at the University of Chicago, the University of Toronto and L'Ecole Normale Supérieure). Conversely, I've been challenged to work with those who thought that math instruction was tantamount to psychological torture. From these varied experiences I have concluded that my goal is to make the students think and reason over questions examined in the course. Needless to say, students need to master a basic content and learn how to solve a series of standard problems. However, while algorithms are easily forgotten, students are very unlikely to forget an idea that they have worked through and truly understood.

In my career I have benefited from a series of exceptional teachers. They were remarkably talented people who generously gave of themselves for the benefit of their students. My goal is to provide my students with an experience worthy of that which I received from my teachers.

## Students' evaluations

*Classical Analysis*, 2nd term 2004-2005.

"Professor Gorodetski is awesome! He does a great job of presenting the material + is extremely helpful + patient outside of class. This was definitely one of my favorite classes since I have been at Caltech!!"

"Prof. Gorodetski did an excellent job teaching this course. His lectures were clear, he rarely made mistakes, and he covered a great deal of material; overall, this was one of the best-taught classes I have taken."

"...He is a great lecturer - explains things really clearly and is awesome at clarifying and answering questions in class without breaking his train of thoughts."

"The instructor lectures at a brisk pace, but is usually very precise, so the lectures aren't difficult to follow. He is also remarkably good at answering questions in a way that get to the root of misunderstanding."

*Classical Analysis*, 2nd term 2005-2006.

"The instructor is great. His lectures are well structured and in the form easiest to understand. He writes quick and is neat on the board, so it never got boring for me. He would mix up some asides which makes the whole lecture and course interesting.

The homework layout was to my advantage; the "easier" problems gave me confidence and a lot greater understanding of the material at more basic levels, and the "harder" problems often required me to collaborate, which enlarges the scope of thinking, and I enjoyed this challenge. This was possible only because the easier problems gave me better basic understanding to which I could build more knowledge upon. ...even though I struggle the most in this class, I find myself enjoying this class more and more as I can feel myself improving and learning."

*Introduction to Mathematical Chaos*, 3rd term 2005-2006.

"The course was very intensive, but very very interesting. The style of teaching was very sophisticated with sufficient interactions with students. The question asked were very clearly explained. The exams and homeworks were at more manageable level and helped a lot to understand material clearly. All in all, brilliant class, brilliant instructor."