TEACHING STATEMENT

JIŘÍ LEBL

1. Teaching Philosophy

I believe teaching mathematics is an important part of doing mathematical research. Both preparation for lecture and helping students in problem sections and office hours has helped me organize my ideas better. Success in the classroom helps create success in research.

My research focus is mainly analysis and geometry, so it is not surprising that in teaching I emphasize the geometric, rather than the purely computational, aspects. My belief is that for example many computational parts of calculus tend to be lost on the student. The student will forget formulas and methods after the class is over, but he or she will more likely retain the fundamental geometric ideas.

As an example, when talking about integration, I talk about a method I have learned from chemists. A typical problem for a chemist is to find the area under a "peak" on the output from an analytical machine. Before software to do so was available, a standard practice was to cut out the peak with scissors and weigh it. As chemists have access to high precision scales, this procedure is turns out to be a reliable method for integration. The point is to emphasize the geometric understanding of integration applied to a real world problem. This example gives a concrete, tangible application of the concept to a real life situation. Students always appreciate such examples.

My philosophy is to explain a few problems well, rather than to run through as many as possible. After finishing the solution, I will often go over the ideas in the computation, and over how to interpret the problem and its solution. I found the book by Polya [7] very useful in many aspects of my teaching. I believe that if students understand a few selected difficult problems thoroughly, then they are better able to work out other problems on their own. I encourage students to work on their own first and try to struggle through the given problems and only when completely stuck (or when they are finished and want to check their work) go talk to their friends or come to office hours.

2. Free Online Textbooks and Underrepresented Groups

During the course of my teaching, I have developed four freely available online textbooks. One for undergraduate differential equations [3], one for undergraduate real analysis [4], one for a mini course using Hermitian forms in several complex variables [5], a course for which I appeared on the list of teachers ranked excellent by their students at UIUC, and finally a one-semester introduction for several complex variables from a classical point of view [6]. Besides my own use of these books the two undergraduate books have been or are currently being used at over a dozen universities. These include, for example, Dartmouth College, University of California at Berkeley, University of Tennessee, Iowa State University, University of British Columbia, and University of Pittsburgh, and many others. The Saylor Foundation [8] is using both of the undergraduate textbooks as part of their online coursework. Both books are approved textbooks in the American Institute of Mathematics Open Textbook Initiative.

One of my main motivations for developing the undergraduate textbooks is to create high quality material available to those sectors of society (and the world) that normally do not have the resources to attend college. Our webserver logs show that these books have been downloaded from all continents including many downloads from the developing world, over 180 000 downloads in all. An example adoption of these books as standard books in the developing world is St. John's University of Tanzania, where both undergraduate books are used where they can locally print copies for less than $2 a copy. Something which would not be possible with traditional textbooks. Both undergraduate textbooks are available as print edition on Amazon (and other sellers including some university bookstores) at very low cost.

3. Computers and Teaching

I believe technology and computers are useful in teaching, as long as they do not get in the way. If a problem can be worked out quickly on paper, the student usually learns more doing it on paper. Computers are very useful for visualizing ideas, but they should not completely replace pen and paper. For example, every student should be able to draw simple graphs by hand and he or she will more likely understand what the graphs mean this way. If the students *only* see graphs drawn by a computer, they might not think hard about what the picture means. On the other hand, requiring everything to be drawn by hand restricts experimentation.

Certain complicated algebraic computations are probably better left to be done by computer so that they do not interfere with understanding of the concepts. Also, being able to use computer algebra software seems like an honestly useful skill to the students. They can spend more time in trying to interpret the results of the computation, rather than spending all of the time on the computation itself. However, I believe such software should only be introduced once they have mastered the basic computation by hand so that they can understand what the computer is telling them. Given the proliferation of such software on the web and in smartphone apps, it appears students will use computer algebra systems outside the classroom setting in any case.

I maintain a free software mathematical package Genius [2], which is aimed at basic research as well as experimentation and education. I use this software in class when visualization is necessary.

I have taught with and without the aid of computers. Besides using Genius, in the differential equations course at UIUC, I have used the software package IODE [1]. With IODE students are encouraged to experiment and to get visual feedback on the material, while learning basics of Matlab or Octave.

4. Teaching Experience

My students have included elementary school teachers, precalculus students, business, science, and engineering undergraduates, and of course mathematics undergraduate and graduate students. I have had the opportunity to teach and help students across the spectrum in many different settings. I taught as an instructor at four different universities: SDSU, UIUC, UCSD, UW-Madison, and now OSU. I taught courses in precalculus, single variable and vector calculus, basic linear algebra, differential equations, and real analysis, and several graduate courses. I am also currently supervising a PhD student at OSU. In addition I was on the thesis committee of two other PhD students (Dusty Grundmeier at UIUC, and Michael Reiter at University of Vienna).

I have given several seminar talks to graduate students and faculty, at UCSD, UIUC, UW-Madison, OSU and other universities, and I have given presentations at many mathematical meetings. In summary, I have had a versatile teaching experience.

References

[1] P. Brinkmann, R. Jerrard, R. Laugesen, *Iode—University of Illinois ODE Package*, `http://www.math.uiuc.edu/iode/`.

[2] J. Lebl, *Genius*, `http://www.jirka.org/genius.html`.

[3] J. Lebl, *Notes on Diffy Qs: Differential Equations for Engineers*, `http://www.jirka.org/diffyqs/`, ISBN 978-1505698190.

[4] J. Lebl, *Basic Analysis: Introduction to Real Analysis*, `http://www.jirka.org/ra/`, ISBN 978-1505695915.

[5] J. Lebl, *Hermitian Forms Meet Several Complex Variables*, `http://www.jirka.org/scv-mini/`.

[6] J. Lebl, *Tasty Bits of Several Complex Variables*, `http://www.jirka.org/scv/`.

[7] G. Polya, *How to solve it*, Princeton University Press, Princeton, NJ, 1957.

[8] *Saylor Foundation*, `http://www.saylor.org/`.