

# Teaching Philosophy

As indicated in my CV, my teaching experience mainly lies in teaching students at the undergraduate level. While I indeed like teaching mathematics at more advanced levels, I do find joy in guiding fresh students towards a level of mathematical thinking; teaching basic material has been more of a choice than an obligation. For the same reason, I have volunteered to outreach activities for young people – being the recurring ph.d.-student on display for the freshmen at their first day at the university, telling about the life as a researcher, as well as giving lectures to high-school students with popular reviews of my research in String Topology and Knot Theory.

I believe that the real gem we as teachers should hope that every student takes away from a math course, is that they have become more independent problem-solvers, and I will always put some focus on maturing their thought-processes mathematically. My experience from the industry as a programmer, indicated on my CV, tells me that mathematical thinking is much more sought after by employers, than explicit mathematical knowledge.

The skills I strive that students will learn involve breaking problems down into discernible bits, thinking problems through from the beginning to the end and finding shortcuts – and seeing how abstraction makes problems appear easier from afar. This is, however, the ideal that I am striving in making my students attain. I find that the real groundwork comes in making the students realize that:

- Other people in the classroom are not gifted with divine insight; everyone, however gifted, has to put their brain at work in order to understand the problem at hand.
- One process in thinking about a problem is to be sometimes confused and stuck; developping tools for the students to work themselves out of such pits is essential for progress
- Real mathematical work is what comes before writing the correct string of symbols down.

It is my experience that as students mature, these things are better rooted – and they become capable of employing their talents. However, the experience I have had teaching freshmen is that a lot of frustration is built in not understanding how to tackle mathematical problems – to me it is important to adress such issues in order to not only have the most talented students ever take a math course again, and leave the remainder disillusioned.

Building on the above, my style of teaching usually involves a good deal of student interaction. At least for danish students, this is not something that comes automatic. I feel that the first couple of times I meet the class, some effort is needed to build an

environment where the students feel safe, and aren't stressed about having to perform in front of me and their fellow students – I try to ask as many questions about the material as the situation permits; for classes of small enough size, I always try to ensure that there is some sort of consensus about what is being written on the blackboard. Naturally, seeking to incorporate this in class can be time-consuming, and a balance towards getting through material must sometimes be found.

I nevertheless put a good deal of weights on the scale towards interactions with the class, and concrete instances of employing this has been:

- Entering an unmotivated and tired class, I have often refused to write anything on the blackboard until someone start saying what should be written. This usually some sort of inertia to build on.
- Having a bright student attempt to solve a problem on the fly, I have employed a dialogue with the student at the blackboard, revealing the thought-process to the entire class
- If no-one has an answer to how a problem should be solved, I will attempt to brainstorm with the class – at least until someone is capable of saying what is complicated or indiscernible
- If someone gives a correct solution, I will make sure that it is still open to debate – both with respect to the process from problem to solution, as well as alternative routes that could be taken
- If students at the blackboard writes symbols without comments, I will make sure that clarifying questions are coming from somewhere in the classroom – preferably from fellow students, and in the last instance from me.