Sebastián Barbieri

✉ sbarbieri@math.ubc.ca
https://www.math.ubc.ca/~sbarbieri
Chilean-Italian, born in August 1, 1989, Chile

Teaching Statement

Statement

My teaching philosophy revolves around three central axes which I believe are an excellent way of captivating attention and obtaining great results with students.

- Mathematics is fascinating if properly motivated, dull if presented as a list of results.
- Learning is mostly achieved through interaction and work rather than passively listening.
- A lecture should maintain an audience oriented balance between intuition and formalism.

To emphasize the first point let us consider the following example. Suppose one were to teach a course in measure theory. If one only aimed to be formally correct it would be possible to begin by describing σ-algebras, pre-measures, Carathéodory's extension theorem, etc. By the time the lecturer gets to the Lebesgue measure and the first illuminating examples of why the measure was not just defined in $2^{\mathbb{R}}$ to begin with, a large portion of the class would have already lost track of the course. I believe that motivation keeps the interest. So instead of doing that, one should begin by asking students what properties we should require out of a measure, then introduce the Vitali set to show that forcefully a function with those properties cannot be defined in every subset of $\mathbb{R}$ and just then begin with the aforementioned concepts. Proceeding in this manner provides a context in which the presented results are meaningful and not just abstract constructs. Similarly, it would be unwise to introduce limits in a first year calculus course without first motivating it with the computation of rates of change.

It is often common that students go to a classroom and get the impression that they understood everything that was presented –specially when the teacher is charismatic– but afterwards are unable to solve an exercise related to the subject. What just happened is that they played the role of an spectator instead of the role of the actor. One should constantly be encouraging students to participate in the classroom by demanding what is the next step, and subtly guiding them towards the answer. Obviously one should be careful not to fall into the typical case where one particular student engages in a dialog with the teacher while the rest of the class fall into a second plane. A successful experience which I have employed these last years when introducing limits is to divide the class into two groups, and simulate an interactive proof of ε-δ arguments. With one half of the lecture choosing values for ε and the other half trying to find δ to satisfy the requirements.
The design of homework is also crucial. It allows the students to explore branches of the main subject in detail without the direct guidance of the instructor. It should be designed so that students are guided towards the correct reasoning without any help from an outside agent.

The third point I want to stress is the balance between intuition and formalism. When instructing a math course it is a non-trivial task to find a balance between the two. In some subjects, such as graph theory or computability theory, the teaching tends to fall towards intuition and risks to leave students with weak theoretical bases from which to perform the correct reasoning. On the other hand, in other subjects such as logic or algebra, it tends to become very rigorous while sometimes leaving intuition in a second plane. There is also the matter of the audience: one should not apply the same strategy to introduce the mean value theorem to a course meant for mathematicians and to a course meant for economy students. On the first case the focus should be on the details, in the hypothesis and the proof. In the second case the focus should be on the intuitive meaning and on applications, specially those related to their field.

In my case, when I introduce a new concept I usually begin with an informal description of the idea, if possible next to a drawing or schema. In this manner when the definition is presented there is no question on what is every part of the definition representing.

Teaching experience and skills

I have taught four courses in the mathematics department of UBC for first and second year students. I have also taught several teaching assistantships both in mathematics and computer science. These assistantships teachings have been taught in English, French and Spanish. I have received very positive evaluations from students in each course I have lectured. They might be accessed through the UBC portal.

I have also prepared quite an array of material for these courses. Exercise sheets, homework assignments, webwork and exams. This has been done in all three languages mentioned above.

During my PhD studies in France I participated in a workshop called MATh.en.JEANS. It consist on preparing a research subject that is easy enough to be grasped by school children and ask them to research about it. This experience is complement by our visits (PhD students and professors) to aid them if they are stuck and help them to focus their ideas. At the end of the academic year they present their findings in a congress specifically designed for them. I strongly believe in encouraging research in young students, and I'm willing to keep participating in such initiatives. These activities serve as a wire between the research one does and the reality of undergrad students which can be useful in order to teach emphatically.

In what follows I list the courses I will have worked in by 31 December 2018. The courses marked as "TP" consist of exercise sessions where I approach each student individually to help them get over the difficulties they might encounter. Those carried out in Chile and those marked by "TD" consist of support courses where either key exercises or branching subjects are presented in a blackboard to students.

Lectures.

2017–2018 **University of British Columbia**.

- 2018 **MATH200**, *Calculus III*, Winter term 1 Sep 04 - Nov 30, 3h weekly.
- 2018 **MATH104**, *Differential Calculus with Applications to Commerce and Social Sciences.*, Winter term 1 Sep 04 - Nov 30, 3h weekly.
- 2018 **MATH253**, *Multivariable Calculus*, Summer term 1 May 14 - Jun 21, 7h weekly.
- 2017 **MATH253**, *Multivariable Calculus*, Winter term 1 Sep 05 - Dec 01, 3h weekly.

Teaching Assistantships.

2015–2016 **ENS de Lyon**.

- 2015-2 **ACM**, *TPL3 48h French*.
- 2016-1 **Foundations of Informatics**, *TDL3, 32h French*.
- 2016-1 **Optimization**, *TDM1, 28h English*.
- 2017-1 **Logic**, *TDL3, 32h French*.

2015–2016 **Université Lyon 1**.

2015-2 **Computer architecture**, *TPL2, 22h French*.
2016-2 **LIFAP1 Programming on C++**, *TPL1, 24h French*.

2010–2014 **Universidad de Chile**.

2010-2 **Linear algebra**, *21h Spanish*.
2011-1 **Ordinary differential equations**, *42h Spanish*.
2012-2 **Game theory**, *21h Spanish*.
2013-1 **Information theory**, *21h Spanish*.
2013-1 **Combinatorics**, *21h Spanish*.
2013-2 **Symbolic dynamics**, *21h Spanish*.

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