

Guidelines for Teaching Assistants

by Franco Vivaldi

Many students reach University without knowing how to learn. As a Teaching Assistant, you will interact with undergraduate students in exercise classes, and your job will involve:

1. teaching the students how to learn;
2. teaching the students some mathematics.

Here we deal with item 1; item 2 is easier. This is a challenging job because the weaker are the students' learning skills, the larger is the gap between what the students *need* (being taught how to think and learn) and what the students *want* (being helped to complete an assignment).

Students with inadequate learning skills have a distinctive behaviour: they tend to replace concepts with processes, and rigorous definitions with informal, vague notions. Thus the inverse of a matrix becomes the computation of the inverse of a matrix, and so they'll do the latter without knowledge of the former. Likewise, the derivative of a function becomes the 'slope' rather than the limit of the incremental ratio, and so they'll be unable to carry out a proof on differentiation.

Such students are often oblivious of the root cause of their difficulties, which makes them very *dependent*. Their primary —sometimes their only— source of learning are the *examples*, so when they get stuck on a mathematical exercise they will scan their notes superficially, looking for examples similar to the problem at hand. If they don't find any, their only option is to declare defeat and ask for help.

But what kind of help? Ideally, the student would want the solution of the exercise, that is, yet another example. The following fictional exchange between a student (S) and a teaching assistant (TA) exemplifies the ensuing tension.

Problem 3. Prove that the function $x \mapsto \sqrt{x}$ is continuous but not uniformly continuous.

S: I can't do problem 3.

TA: Show me what you've done so far.

S: Nothing, I am just totally stuck.

TA: What does uniformly continuous mean?

S: (*Pause*) I don't know.

S's question is *generic*, it contains no reference to the subject matter. This is often a symptom of underlying problems. (By contrast, a student with good study skills may say: 'I don't understand the difference between continuity and uniform continuity'.)

TA replies with a *request* —as opposed to an *explanation*— which S is unable to meet. Normally, the work done by S before seeking help would be the starting point for a conversation on the mathematics, but S hasn't produced any evidence of work.

Thus TA asks a *question* —still no explanation is offered— whose purpose is to verify knowledge of an essential pre-requisite concept. Again, S is unable to answer. Note that S's disappointing replies are not necessarily due to plain laziness. Some students are so unaccustomed to independent work, that they believe that the exercise class is where you begin to think about your assignment.

What should TA do next? The educational problem has shifted: improving the student's resourcefulness is now more important than teaching uniform continuity (although this is unlikely to be what S *wants*). The core message to be delivered to S is that *there were things that S could and should have done before asking for help*. Thus TA may decide to

- ask the student to read the relevant part of their notes, and then encourage them to call again;
- inspect the lecture notes with the student, to ascertain if the student is familiar with them;
- stimulate the student's resourcefulness with a friendly provocation ('if your life depended on making some progress on this problem, what would you do next?');

etc. TA should experiment with different courses of action, to build an arsenal of responses to different situations. Once the student has met TA's request, the conversation can finally return to the original mathematical problem.

From the comments above we distil a few rules of engagement with the students:

- *Try to answer a question with another question.*
- *Ask for evidence of preparatory work; if you see insufficient effort, then say so clearly.*
- *Verify systematically knowledge of exact meaning of key terms.*
- *Check familiarity with lecture notes; never help a student navigate their own notes.*
- *Raise your expectations: demand hard work and sense of responsibility.*

If you experience any problem, do not hesitate to contact a member of staff; there is one in every exercise class.

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