Teaching statement

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Patience

In my experience, any individual student is more likely than not to understand any one particular topic quickly. When they don’t understand a new concept immediately, however, it can take a serious amount of time and effort for them to get to the level an instructor would aim for when first introducing an idea. This is easy to forget; the usual structuring of courses has a tendency to smooth out the speed at which concepts are explained, so that ideas which are immediately clear are often dwelled on for too long while difficult concepts are presented too quickly. It’s no mystery why this is the case. Different students will get stuck in different places, so improving on the existing practices is difficult. Nevertheless, I find it very helpful to keep in mind that I teach at the speed I do because it is a rough approximation of the ideal, and that whenever I have the chance I should be very attentive to what’s in front of me. I should go out of my way to react to what I see without any expectations for how long it’ll take students to understand something. I have, on many occasions, spent hours and hours letting students ponder, struggle, and eventually grasp individual concepts while only ever prodding the student as gently as possible. I truly believe this is the most effective learning experience someone can have. It is very much worth learning an idea properly once, as opposed to trying to achieve understanding through short periods of shallow consideration. This notion is universal, and manifestations range from Paul Halmos’ “Don’t just read it; fight it”, to the common advice given to chess novices to play longer games instead of blitz time controls.

There is often a strong temptation as an instructor to guide the student more than is helpful, and I think this temptation in part comes from the usual pacing in classrooms that is much faster than reasonable. There is no substitute for the genuine understanding that comes from figuring things out for oneself, and I view my role as being one to help people find the motivation to fight this battle. I help them fight the fatigue and exasperation, as it is natural, of course, to tire while learning like this. A common reaction of students to the exhaustion, for example, is to start guessing at answers which they then expect the instructor to confirm or reject. Sometimes it’s reasonable to indulge a student in these situations, lest they become unhappy. However, whenever possible, I prefer to just take a step back, to relax, and to just interact on a more human level until more strength builds. Clearly this is not something that can be done in lecture, but the purpose of a lecture is never, and will never be, to impart deep understanding of the material. Instead, I hold very long office hours, and am generally willing to engage with students in whatever way interests them. The hardest part of teaching is not explaining; it’s motivating.

Storytelling

The purposes of lectures are to energize students and direct their efforts. An unhappy person is going to resent working on whatever is making them unhappy, and that significantly hinders any attempt of theirs to learn, retain information, and most importantly invest themselves in the material in the future. An educator should then focus on making sure their students are having as positive an experience as possible, even if it occasionally means making concessions in other areas. When you teach a friend how to play a new game, the most important part of the experience is making them want to play a second time, even if the end goal is to produce a strong competitor. This is just what it means to be human; there are no strong chess players who dislike chess. To do this, a teacher must teach in a specific way, and focus on fostering enjoyment over conveying the maximum amount of information possible. Sometimes students have specific and inflexible goals, like doing well on standardized tests to impress future employers, and the philosophy of emphasizing enjoyment has to compromise with these kinds of realities. Nevertheless, this is an important guiding principle for me.
My experience with academic education is that the objective of the instruction is for students to know solutions offhand to problems they encounter in the future. This is unrealistic to the point of being unhelpful. Instead, someone faced with the unknown has to have the motivation to seek an answer, then they must know how to look for an answer, and finally they need to have the skills to work with whatever they find. Mathematicians know all too well how easily people can falter at the first step, so, naturally, overcoming that is the most important concern of an educator. However, there are many ways one can generate interest in a topic, or at least avoid serious negative experiences, and so the question then should be: what else should an instructor strive to do in parallel to generating interest? The answer, in my opinion, is to begin work on the second step of this learning process; while generating interest, an instructor should emphasize that the knowledge they’re teaching exists, as opposed to teaching the content of that knowledge, so that students know what to get excited about, and where to look if they want to do something with their excitement. People don’t remember details. Instead, people build the skills they need to learn new topics, as well as knowledge of what there is to learn. Teaching details to the exclusion of these other aspects of subject matter is inefficient and generally unpleasant.

Together, these objectives make teaching feel like storytelling to me. I’m leveraging my charisma to entice listeners. I most importantly want to give them a positive experience, but also pass down an oral tradition which I don’t intend them to retain literally and instead to benefit from in a more holistic way, becoming more well read, more cultured, and better equipped to confront the mysteries around them. A good storyteller is knowledgeable about the world their narrative lives in, just like the best textbooks often come from strong mathematicians, even for basic topics. A good storyteller can improvise when it benefits the listener, just like a good teacher will take students’ questions seriously and sometimes use them to venture off the beaten path, inspiring their students with what’s to be found.

**Challenge**

People have a tendency to hear what they think they know instead of what’s being said. They will project their own ideas onto what’s presented to them, and be attentive to similarities instead of differences, which is counterproductive. When it comes time to explain concepts this is the biggest obstacle facing an instructor. The way around this obstacle is challenging the students, and this is best done by specifically acknowledging common misconceptions immediately before presenting key differences. When someone is first presented their own ideas and then a contrasting idea, it’s almost impossible to ignore the difference between them. However, if only the contrasting idea is presented, they might not notice the what separates it from what they already believe. Unfortunately, this conflicts with the tenet that a student’s happiness is paramount, because generally being shown why one’s ideas are wrong is an unpleasant experience. There is little point in explaining effectively if students aren’t willing to listen in the first place nor willing to use what’s given to them.

One technique I have for dealing with this tension is to instead focus on explaining the material from a different perspective or with a different emphasis. If the students have no preconceived notions of what they’re learning then this interference effect won’t come into play. This principle of avoiding the interference problem has shaped me a great deal as an instructor. Like everyone, I’m a victim of the problem myself, and I have salient memories of conversations with excellent mathematicians that were less useful to me than they could have been because of my naivete. I keep the problem in mind constantly when interacting with people around me, and find myself learning more and being more effective as an expositor on a daily basis. Most importantly, when I teach, I present approaches to the material that students are unlikely to be familiar with when all else is equal, and I’ve found this to be remarkably effective. As students progress in their education they become more effective learners, and they’re sometimes fettered by strong connections they’ve made in the past, when they were less adept. Commonly a student will be burdened by past knowledge because any benefit they derive from their familiarity with the material is outweighed substantially by the detriment of being hampered by their incorrect preexisting notions. Simply learning of new ideas becomes less difficult than one might expect as students become better at the act of learning.
This approach to teaching simultaneously trains students to develop skills that are otherwise hard to emphasize. Normally, in an academic environment, the focus is on conveying factual knowledge, and not teaching students how to make new connections. This is by necessity, because it’s very hard to teach anything but factual knowledge, and the effective ways to teach other topics will vary dramatically from student to student in general. Nevertheless, sometimes there will be an opportunity that presents itself which will allow for teaching difficult topics in a way that will be compatible with a lot of students, and being challenging but evasive in the way described here leads to such an opportunity. Presenting novel approaches to material students already have some familiarity with allows students to form connections in a healthy way; in addition to feeling very rewarding, it shows them how to build the skill of connecting new ideas to what they already know while avoiding the harmful interaction discussed earlier. Not only is this a reprieve, but can help students help themselves in the future.

Passion

Teaching is hard: students learn slowly and a teacher can do little but stand by them while being encouraging; students are reluctant to work hard and sensitive to unpleasantries; and students will often substitute misconceptions they’re already confident in in the place of novel information. Moreover, teaching is undervalued. I was given very little training before teaching my first course, and this is not atypical. It’s expected that researchers to teach by pulling from their experience as students, and often the culture is that teaching is a chore and a distraction from one’s research. Academic institutions produce metrics for success which are very uniform, and designed in large part so that an overwhelming majority of students can succeed despite the uniformity of the evaluations. What I take this to mean is that if I am to be a good teacher, the impetus can only come from me. As a research mathematician, I could teach relatively bland, uninspired, generic courses and put the onus on students to make themselves into as much as they can be instead of troubling myself with the harsh difficulties of pedagogy, and I think I could do so easily. But I love teaching. I genuinely want students to excel, and constantly I do whatever I can to help people all around me learn, only because I care deeply about learning for its own sake. I don’t teach because I have to meet any external criteria, but because I personally feel that it is how I can best make the world a better place. These feelings come in no small part because of the people who taught me the most. The remarkable teachers I’ve had, like Henri Darmon and Jeremie Vinet, all did what they did out of the goodness of their hearts, and all went far beyond what was required of them. I understand that the requirements of academic institutions are as they are for good reason; not everyone has the passion to teach, and logistically it’s sound to assign researchers teaching duties. I am lucky that I have the drive to push past where the benchmarks must lie, and I have every desire to make as much of that drive as I can.