Teaching Philosophy

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Mathematics is the language of analytical reasoning. Contrary to common belief, mathematics is also a weave of patterns just like painting or poetry, and in this sense is a form of art. While painting and poetry are done with shapes, colors or words, the fabric of mathematics rests on pure ideas. A math teacher's responsibility is to help his/her students learn this special jargon and appreciate the patterns woven with various ideas. We are all gifted with certain natural abilities of learning languages and recognizing patterns, if properly guided. So it seems plausible that anyone can learn mathematics, at least up to a certain level. Unfortunately, however, many undergraduate students come into math classes with fear and apathy. So as the instructor, besides teaching the course material, my goal is to ease this tension between my students and the subject.

Presentation is the most important aspect of teaching. Presentation of mathematics is not merely a statement of definitions, formulas and theorems on the board or slides. It should provide a bridge connecting the already known with the unknown along with a strong sense of direction.

In some of my lectures, I start by calling upon the concepts that my students have already acquired. Next comes the explanation of the motive and how the current notions would fail to satisfy that. This provides an urge to move forward. After the initial stage setting, I start filling in the gap by introducing new ideas, a piece at a time and moving step by step towards the goal. For instance, before introducing derivatives in an introductory calculus course, I would spend some time talking about the problem of finding the slope of a tangent to a curve, demonstrate with examples where Euclid's definition of a tangent does and does not work. Then once there is a clear understanding of the need for a more sophisticated theory, I move on to the limit definition of a derivative and explain how it solves the anomalies that arose due to the limitations of the previous theory.

On other occasions, I introduce the new ideas first and then tie these up at the end to complete the picture or connect them with what the students already knew. An example of such a lesson would be my introduction to integral calculus. In this case I describe the area problem briefly and then introduce the Riemann sums, which is a new concept for many. This is followed by the definition of the definite integral using the Riemann sums and the connection between integrals and areas. The climax here comes with the Fundamental Theorem of Calculus, which connects the two branches of calculus and establishes the link between the processes of integration and differentiation. During the course of this presentation, students often complain about the length of the Riemann sums and question why they are not allowed to "just integrate", but in the end I think they appreciate the complete picture. This is indicated in student comments, such as the following. *"Dr. Basu was excellent at giving detailed explanations or example problems as well as giving us a proof for it, even if it was not necessary. He wanted to make sure that we all learned everything we could, even if it meant he had to take 5-7 minutes out of the class time to prove why you do something the way we did instead of just telling us that we had to do it that way. He would*

rather have explained it to us instead of telling us to just look in the textbook. He was an excellent professor."

In each of these cases, I make every effort to stimulate the intuition and creativity of my students by letting them speculate the next steps. This serves to intellectually involve them in the material. At the same time, I think it also gives them a certain amount of confidence as they work through the steps instead of just accepting a collection of facts from the instructor. I choose my examples with care so that they rightly emphasize the aspects of the new material that are critical for a true and complete understanding. Also, I make sure that my examples gradually go up in the level of difficulty so that by the time we are solving a not-so-easy curve sketching problem in an introductory calculus course for instance, they already know all the steps and I can then act as just a scribe while they execute the steps to find the shape of the curve. However, not all of my examples are pre-meditated, some need to be made in class to further clarify an idea, or to clear a doubt.

The effectiveness of a presentation depends quite substantially on the rapport between the speaker and the audience. This connection that needs to be set up in each and every class, ensures the smooth flow of the sessions for the teacher and the students as a single body. Calling and waiting for questions is crucial for setting up this bond at the technical level. Besides that, I use well-spaced breathers in the form of friendly humor to square this relation. Overall, I try to maintain a lively and jovial atmosphere in the classroom in spite of all the mathematics. Another important thing that I always keep in mind is that different people assimilate knowledge in different ways - some students can understand the abstract form, some need examples or applications, while some others need a visual representation. Thus, I generally provide multiple explanations to a theory to optimize the understanding in class. Keeping with the fact that every presentation is a performance, I take great care in preparing my lectures. Following is a student comment that justifies my approach. *"Dr. Basu himself is an incredibly knowledgeable professor. He is incredibly skilled in mathematics. This, paired with his patience and understanding, made him a quality professor. Plus, he sprinkled enough lighthearted humor into his lectures to keep them from getting too dry or unenjoyable."*

Homework, quizzes and exams comprise another important aspect of teaching. These also require a certain amount of thought and planning. Homework and quizzes should not be extremely difficult - that would just crush a student's confidence. Neither should they be too easy as that would be harmful for the seriousness of the course. The problems need to be carefully chosen to enhance one's understanding of the concepts taught in class. I select my problems so that students can build on from the examples done in class and face the increasing challenges independently as they move forward. I always encourage them to work in groups, since explaining what they learned to their peers is a great way to improve their understanding. Typically during my quizzes I would ask them to work independently for the first half of the allowed 25 minutes and then work in groups. Most of my students have come to like this arrangement and say that this helps them in their learning process. Deadlines are essential for maintaining a course structure, but I do not over-emphasize them. Mastering the concepts is far more important than somehow managing to do the homework and submitting on time.

Office-hours - nothing can be said to adequately express the importance of these. In spite of my best efforts to encourage questions in class, students do not always feel comfortable speaking in the presence of peers. Office hours provide an opportunity for them to interact one-on-one with the instructor. Besides, these are also great for clearing off doubts that surface from the lectures, the in-class examples and homework assignments. I always urge my students to make use of them. Office hours allow me to get to know my students better, look into their difficulties more closely,

and guide them. This in turn helps me shape my lectures more effectively.

Teaching, to me is a unique experience and has many more facets than those mentioned above. There are many little things that go into building a strong relationship of mutual confidence and respect between the students and a teacher. I plan to continue to look for ways to improve my skills and incorporate new ways of effective interaction. One such way would be through some of the new technologies that have become available now, like Wikispaces, Blogs and Piazza. These would be excellent places to start and run content-based discussions outside the classroom. I think these new methods of instruction can also help bring the technologically equipped present generation closer to the old, and most often formidable, but indispensable and profoundly beautiful subject of mathematics.