

Teaching Statement

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Summary

Teaching is the opportunity and responsibility of the learned to impart their knowledge to the next generation. I believe in giving a rigorous, motivated, and interesting approach to mathematics. I am best be described as innovative and passionate; I believe students deserve an education with the highest reasonable standards.

I think the most obvious quality of my teaching is my innovation. In particular, I place most of the emphasis on the key concepts as opposed to rote memorization and computations; I take care to explain the concept behind the material. Details, algorithms, examples, and everything else that is used as part of instruction is secondary and either reinforces or unveils the concept. This is all while adapting to students based on their input.

The following is a synopsis of what I have learned so far from the years that I have been teaching, separated for convenience by teaching strategy.

Strategy: Conceptual Approach

I rarely give students an example before explaining the concept or pseudocode for an algorithm before going over the idea behind it. The emphasis on understanding is critical.

Example: Differentiation

When teaching single-variable differentiation I use a picture of a generic function and its secant line approaching the tangent line. After the students have been exposed to the idea I will go through examples and the algebraic details. By seeing the concept first they have an idea of what is going on, and then as a class we construct the details to match their understanding.

Example: Income taxes

When teaching financial math one of the topics I've covered is U.S. federal income taxes. In this case I first illustrate the idea behind our tax structure and how the tiered levels cause different parts of one's income to be taxed at a different rates. Once they've seen the picture and understand how taxes work they can compute the tax without even needing to use a complicated formula or the algorithm our textbook presents. Afterward, to further reinforce their understanding, I do show them the book's presentation and they realize that what the book says to do is exactly what they already know.

Strategy: Students own their understanding

When a student asks me a question in my office I rarely tell him or her the answer. The answer will not help the student understand. Instead, I will respond with a question of my own, slowly guiding them to figure out the concept. A struggling student may need several hints and guides before being able to "connect the dots" for himself. This takes much more time and effort than giving the answer or working

a similar example; more importantly it is quite effective at helping the student develop their understanding. My students leave my office owning the material for themselves.

Example: Valid Arguments

When helping a student in math 101 with logic and valid arguments, I will not tell him whether or not the argument is valid. I will instead ask him to identify the objects in the premises and how they interact. Then, I will have him draw out the relationship between the objects. Once he has done that I will have him identify the conclusion and it is usually clear at that point whether the argument is valid or not.

Example: The Unit Circle

I have encountered many high school and college students that have taken trigonometry or calculus and have memorized a dozen or more values for the so called "Unit Circle". Most of these students have no understanding as to where the numbers come from or the geometry behind them. I have taken hundreds of students back to the basics of triangles and circles to help them develop an idea as to why the "Unit Circle" exists. This allows the students to derive the values for themselves. Similarly there are numerous other easily accessible concepts students often miss such as factoring, Riemann Sums, permutation groups, and compactness.

Indeed, it takes more time to derive what one needs than to memorize a dozen things they might need. However, in a year or two the memorized items will be forgotten. The intuition they have developed from deriving it themselves will linger in their mind, and they just might be able to derive what they need in the future.

Strategy: Adaptive Lectures

I prefer to lecture from the board as opposed to a computer. This is because I think it is best that the student sees how the math is actually performed. I do not copy from my notes, but rather talk myself through the problem as I do it: explaining it to the class. I typically prepare notes to hand out to my students that have the objectives, definitions, theorems, and examples (without solutions). The idea here is that they have a reference on which I can expand upon with the details.

Example: Solving an equation

Suppose I am teaching algebra and need to solve an equation. By showing a worked solution, even with explanation, it is difficult for the students to see the thinking process. Instead, I prefer to work through it in real time on the board. I talk to the class while working the problem: so that at each step when I am forced to make a decision as to what to do next they can see how I handle it. They can see how their classmates would do it: I ask the class what they think should be done and have them lead me through the problem. This is impossible using slides because you cannot adapt your method based on student input.

Example: Alternative explanation for preference schedules

Many topics, such as preference schedules used in voting theory, have multiple intuitive explanations. After giving the first explanation regarding order of preference of candidates, I can gauge the understanding of the class and determine if they need another explanation or not. If students struggle with the first explanation I can try a different approach regarding what-if scenarios. This way the student sees [at least] two different viewpoints.

Strategy: Instructional Activities

At times I have been known to give learning activities (group work) in class, but only do so when there is more class time than class material. Class time is a valuable time for the students to learn from the professor; it feels wasteful to have students do homework-like activities during class. On the other hand, I have often engaged the students in instructional activities.

Example: Analyzing the Experimental Process

When teaching about experimental methods I performed a novel experiment on my students and had them find all the flaws in the experiment. In particular, I posed myself as trying to show men were better at throwing than women. The experiment I performed included having each student in the class throw a small object at a tin can on the other side of the room. I recorded the results and performed statistical inference. I purposely made mistakes such as giving the men and women different objects to throw, not checking the requirements for the inference I used, and telling them that I hoped to show men were better at throwing than women. Afterward, I allowed them to discuss amongst themselves to determine all of the errors I made, and then we discussed their findings as a class.

Strategy: Student Input

Student input is possible during class when soliciting responses or ideas from students. However, I feel it is also important to be able to gauge how effective certain teaching methods are. To this extent I have had two approaches beyond the typical analysis of student success. Firstly, between the first and second test I have given anonymous midsemester evaluations where the students can comment on teaching methods I have used. While this information was critical in my first couple semesters of teaching, students still sometimes provide a suggestion that had not occurred to me. The other method is varying my teaching method from section to section.

Example: Multiple Sections

When I have two sections of the same class I have tried structuring them slightly differently or explaining a concept slightly differently. An example of the former is when I purposely staggered my sections slightly so that I was not teaching the same lecture on the same day, but rather had time to reflect from one class to the next. An example of the latter is when explaining combinations one section had a difficult time grasping what it meant to be unordered: in the second section I went into more depth on the symmetries of a permutation before introducing the idea of a combination.