Key Ingredients for Undergraduate Mathematics Instruction

A Teaching Philosophy by David Koslicki

In my five years of teaching and tutoring at a variety of levels (from elementary linear algebra, to calculus and beyond), I have identified four concepts that are key in effectively teaching mathematics: preparation, engagement, patience and passion. Effectively employing these four concepts has led to my receiving the Penn State graduate assistant teaching award. I have also had the opportunity to assist first-year graduate assistants in improving their teaching capabilities by serving on the Graduate Teaching Association Committee at Penn State. This committee runs a mandatory "teach you how to teach" class for incoming graduate assistants where I have had opportunity to collaboratively improve teaching techniques by employing these four concepts. In this teaching statement, I aim to expound upon these four key concepts.

**Preparation**

"The teacher was absolutely awesome. He was so helpful and answered every question and knew exactly what he was talking about. One of the best teachers I've ever had by far."--Student Review

I believe that thorough preparation and the development of a clear plan of presentation is vital for the effective communication of mathematical ideas. The logical development of a concept must be clear to an instructor before there is any hope to communicate the concept to a student. This is why I typically write my notes well before class, and publish them on my class website so students can use them to prepare for class, to follow along during class, or to use later as a reference.

Furthermore, the instructor's preparation must be thorough enough to anticipate possible questions or difficulties that might arise and develop alternate examples or avenues of exposition in such cases. While time consuming, thorough preparation is the foundation for the effective teaching of mathematics.

**Engagement**

"He was fantastic. Was always very enthused and liked to stimulate discussion. Always asked if anyone had questions. I felt like he genuinely cared that we learn the material and would do anything for us to understand it."--Student Review

An audience must be engaged (i.e. attentive and interested) before an instructor has any hope of effectively communicating a mathematical concept. I have found that audience engagement is directly tied to the audience's perception of how much the instructor cares about the learning of the material. The average student can immediately ascertain if an instructor genuinely cares if a concept is understood, or if the instructor is simply going through the motions. Accordingly, time must be taken to understand the audience's perspective on the class and utilize this as an avenue for generating interest in the subject material. Once the audience is convinced that the instructor is invested in their learning, open communication and feedback becomes possible. Students will rarely ask questions or
communicate that a concept was unclear if they perceive that the instructor does not care about their learning.

Finding ways to relate the subject matter to the interests of the audience is sure to increase their engagement. For example, during the beginning of the semester I typically have my students fill out a short questionnaire that asks why they have enrolled in the class, what their expectations are, what their fields of interest are, etc. I use this information to then tailor the class to the specific needs of the audience. One semester I taught two sections of Calculus, with the first section have mainly engineering majors, while the second section had mainly Liberal Arts majors. This information allowed me to customize my examples and general presentation style so as to be relevant to the audience and increase their level of engagement.

**Patience**

"Excellent teacher, I hope he wishes to continue teaching in his career. I wish more teachers were like him. He is approachable, not arrogant, understands [students'] frustrations about learning new concepts. [He] has the patience to tackle problems in multiple ways to be very effective in communicating to his students."--Student Review

As any mathematician knows, comprehension often does not immediately follow upon exposure to a new concept. It is essential to remember this fact when teaching mathematics. An instructor must strive to remain empathetic and patient as students grapple with the subject material. Losing patience or failing to remain empathetic is a surefire way to discourage students and convince them that a concept is "too difficult" or "too complicated" for them to understand.

Since many different learning styles exist, I find it helpful to develop a variety of examples or exercises that emphasize different solution styles. Particularly when working with individual students, I have found that patiently proceeding through these examples is an effective way to discover a students learning style and hence facilitate comprehension.

**Passion**

"Koslicki's enthusiasm for calculus was contagious."--Student Review

"The instructor for this class made learning very fun and interesting. Everything was very clear and he was always willing to help any student in class. I learned a lot about a subject I had the least amount of interest in and it was all because of the teaching style of this instructor."--Student Review

I have found that particularly when teaching undergraduate mathematics classes, an instructor's passion for the subject is crucial. If the instructor is uninterested or indifferent, students will interpret this as a sign that the subject material is unimportant, boring, or dry. Conversely, when an instructor maintains a passion for the subject and a passion for learning, students in general become more willing to engage with the material and maintain a better chance to learn the material at a deeper level.