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STATEMENT OF TEACHING PHILOSOPHY

As I watched the seconds ticking towards 10:07AM, I readied myself for a grand entrance into my first calculus class this semester. My heart was beating rather faster than the seconds were ticking, but I enjoyed the feeling of adrenaline pumping into my system.

Because I wanted to grab the attention of my class right away, my first innovation this semester would be to arrive only seconds before the official start of class, stroll in confidently, and start class right on the dot. I wanted to reduce the lag time between calling the class to attention and actually getting their attention, by not having to call them to attention at all. Rather, I would simply attract their attention automatically. My new strategy worked. The eyes of my students were instantly drawn forward, and the students laughed when I joked about making sure I found the right classroom. Because I wanted to set them at ease, I joked again in telling them my name and my internal debate about what to have them call me.

GAME PLAN FOR THE MATHEMATICS CLASSROOM

I believe that all of my courses are best taught from a student-centered approach, in which I take care to create and maintain a dialogue with the students and to repeatedly solicit their feedback on how the course is meeting their needs or could be improved. A particular example of my commitment to the student-centered approach is the course on Introduction to Proof (Math S-101) that I team taught with a senior instructor this past summer in a seminar-like setting. We helped our students to teach themselves and each other by requiring them to present assigned homework problems on the board each class period. They would receive feedback first from the other students, and then from myself and my colleague. I believe that this approach was very effective in helping students to harness and hone their intuitions about proof, which intuitions they then polished as I continually provided them with extensive written comments on corrections of their homework write-ups.

I believe it is crucial to listen carefully to each student and address their concerns as early as possible, so I have borrowed another idea from colleagues and am trying out the “minute survey.” These surveys comprise a half sheet with three or four short answer or multiple choice questions regarding the concepts that students feel they learned that day and those about which they are still confused, student opinions on the pace of the class, and any concerns they may have; I distribute the surveys at the beginning of class and collect them at the end. By offering the students many chances to give me anonymous feedback in real time about how the course is (or isn’t) meeting their needs, I can make quicker adjustments to my teaching style and help to make the course work better for as many students as possible, as early as possible. Asking the class to complete minute surveys also gives the students a greater sense of their role as active participants in making the class what it is; they realize that they have some choice about the direction of the class, and that they are expected to exercise that influence constructively.

Indeed, in any class, I believe that the sooner and the more emphatically that my students understand the need for their active engagement, the better. Student participation is not merely a luxury of a small class; participation is the key to its success. So, from day one, I create an environment of involvement by asking direct questions of the class, making sure to start out easy enough that most, or even all, of the students would be able to answer with confidence. After asking a question, I pause to give them time to consider while I smile in encouragement and look on thoughtfully. If unable to elicit a response on the first try, I reformulate the question and then wait, reminding them, if necessary, that I’m happy to take even a guess if that’s what’s needed to get things started. I make it a point not to answer my own questions, unless one or more students have taken a stab at it first; I will alternately cajole them and allow for moments of silence until someone takes up the challenge. In this way, my class comes to understand that my questions are not merely rhetorical, and they open themselves more readily to my invitation to participate.

THE OXYGEN OF HEARING

It is important that the students feel heard, validated, and rewarded for participating. So I am always seeking opportunities to listen to each student, in and out of class. I use a motivating or challenge question to jumpstart

the class discussion of a given topic, then I break down the larger question into smaller ones, so that we can build up to answering the larger question step by step. I repeat each answer that I receive from the students, so that everyone can hear it. I enthusiastically thank the student for his or her response, and ask the rest of the class if they agree, finally affirming the response if it is correct, or, if incorrect, seizing on some aspect of it that points in the right direction. In this way, students actively participate in the discovery of the solution.

In general, a skillful and judicious use of pauses, refinements of questions, and dramatic gestures encourages participation, allowing students the time to absorb each new concept and example, to think of a response when I ask them a question, or to ask a question of their own. I heard a famous orchestra conductor once say, "Silence is the oxygen of hearing." In each class, I aim to keep the proportion of speaking to pausing such that students remain alert and the course flows naturally. I frequently invite my students to ask questions, and I repeat each question as I am asked it, both for the benefit of other class members who may not have heard properly and to be sure I have understood it correctly myself. I pause briefly to get my thoughts in order, then I answer directly and considerately, checking in to see whether the student and the rest of the class are satisfied with the answer. I want them to recognize both my enthusiasm for mathematics and my willingness to help.

ONE CLASS AT A TIME

While considering what strategies to use in a particular class, I find it important to be flexible and take into account the class size, level, and pace. What may be effective in one setting may not translate so well to another. For instance, in my medium-sized Linear Algebra and Differential Equations section (Math 21b), where I was my students' sole instructor for the course, we had so much material to cover that a fair amount of lecturing was not only inevitable, but desirable. I ensured that the lectures employed enough of a Socratic method, however, that the students themselves delivered the key points in answers to questions. Moreover, making sure that my students left class with a sense of the larger picture was just as critical as helping them to understand the concrete examples.

In my smaller Integrated Pre-Calculus/Calculus class (Math Xa), however, I am taking a more hands-on approach (although I am once again my students' sole instructor). With the goal of helping my students to organize their note-taking, I bring worksheets to each class that have the day's examples and exercises printed on them. While it is important for students to take careful notes, I feel that it is even more important that they spend less time copying from the board and more time trying to understand what they are copying. On the one hand, having class notes completely prewritten for a student can dampen the student's incentive to pay close attention in class or to make the material their own through the act of writing; yet, on the other hand, expecting them to copy everything on the board from scratch can leave them with little time to think while they furiously try to scribble everything down. I believe that it is important to strike a balance between these two extremes, especially in introductory courses, where students may not yet have figured out their own most effective personal strategies for studying college-level mathematics. With worksheets, the students still end up having to write down the solutions and thereby make them their own.

STRATEGIES FOR PREPARATION

In preparing for each class, I find it essential to have easy-to-refer-to one or two page outline with announcements, goals, key concepts, and a motivating question or other starting point. By having an outline in addition to notes, it is much easier for me to change my class plan on the fly in order to better adapt to the questions and difficulties that my students actually encounter. I still believe it is important to work out the details of each example in notes beforehand, but by keeping the notes separate from a short "road map" of sorts, it is much easier and faster to get back on track after any detours, or to omit less important examples if time runs short.

To supplement the outline, I bring notes full of carefully chosen examples to illustrate each concept. I usually start from easier examples and then move on to more complex ones, so as to engage people in the class who may be at different levels. Because I know that written and oral communication are important ingredients of mathematical literacy, I frequently bring write-ups of the most important or most complicated examples to the following class, so that students can emulate them both in writing their own notes and in writing up homework sets.

One of my guiding policies is to assess honestly after each class period which approaches worked and which ones to renegotiate in future classes. So at the end of each class I jot down notes on how things went and reminders about what actually was covered. When getting ready for the next class meeting, I address any issues brought up in student feedback as well as in my self-assessments.

I also take seriously the need for a few minutes of mental and emotional preparation before each class to collect myself and channel my adrenaline most beneficially before entering the classroom. I pause, clear my mind, take a few deep breaths, and focus on teaching my students and enjoying the privilege of doing so.

ONE STUDENT AT A TIME

One-on-one interactions are an integral part of teaching, and a great opportunity to help instill a love of learning in my students. So I make it a point to be as available to my students as possible outside the classroom as well as in it. Besides holding regular office hours, I gladly extend these hours whenever students have more questions than the originally allotted time allows us to address. I give the students my full attention, and guide them through their mathematical difficulties with passionate empathy. For the Introduction to Proof class, I held such exhaustive sessions several times a week, and my office hours were so popular that during each scheduled hour there was always at least one student, and usually several, who came in for help.

Where needed and when desired by the student, I am willing to work intensively with him or her. For instance, I had a couple of students in my Linear Algebra class who took me up on this offer and made dramatic turnarounds in their grades. One of them, a shy young man from Maryland who took the course because he “figured it might be useful,” came zealously to each of the many review sessions I gave for the final exam, asked several questions, and did well enough on the exam to bring his grade up from failing to a B+. I learned from working with him that even reserved students can be coaxed into coming to office hours if patiently prodded enough. Another student, a young woman on the rowing team who wanted to major in Computational Biology, came to countless office hours and meetings by appointment with me in the weeks leading up to the final exam, as well as to the concentrated review sessions that I gave for the whole class. I worked painstakingly through the questions that she had and made tailored suggestions for the areas on which she needed to spend more effort. She responded willingly and gratefully, and mustered the confidence and competence to score extremely well on the final exam, bringing her grade up from a D to an A. In my experience with her, I felt a thrill in encouraging and facilitating such evident determination on her part, and I learned how to help someone successfully review and master a large amount of material in a relatively short time.

The time that I have spent over the years tutoring and mentoring individual of various ages and levels—from bright 6-year olds to middle-school students to high school geometry students to college calculus and multivariable calculus students—has helped me to refine my skills in working with students one-on-one. Because I want them to feel heard, I repeat their questions to be sure I understand each of their questions and hurdles. I answer their questions with questions, where appropriate, thus assisting them to find the answer rather than just have it told to them. In this way, I engage the students, and they usually end up having fun; I also have a mental collection of pep talks that I tailor for each struggling or uncertain student to encourage and help bolster his or her confidence, and to make sure that he or she knows that I care and am here to help as much as possible.

RESEARCH BEGINS EARLY

Having myself participated in two National Science Foundation Research Experiences for Undergraduates, I strongly believe that interested undergraduates should have the opportunity to explore research problems in mathematics. As my own research area is especially well suited for undergraduate researchers, I am excited about the possibility of directing undergraduate research and would be glad to seek out problems in Combinatorics for undergraduate students to investigate. Because it is important to encourage and help develop students’ research abilities early, I will gladly mentor undergraduate researchers with patience and enthusiasm, meeting with each of them as often as is useful and coaching each student along without taking the thrill of discovery out of his or her own hands.

THE POETRY OF MATHEMATICS

I strongly believe that mathematics is a liberal art and that learning to think critically and analytically by doing mathematics benefits every student, regardless of major. I will continue to fine-tune and build on my repertoire of classroom strategies, particularly by being willing to try new ideas and constantly looking for

specific ways to improve those already in play. With the overall goal of fostering the curiosity and promoting the creative thinking of non majors and majors alike, I look forward to spending my lifetime imparting mathematical knowledge to generations of students. I aim to transmit to them an appreciation of both the beauty and the utility of mathematics, and to help them experience the sense of accomplishment gained by solving challenging problems. As Bertrand Russell remarked,

The true spirit of delight, the exaltation, the sense of being more than Man, which is the touchstone of the highest excellence, is to be found in mathematics as surely as in poetry.

Because my own undergraduate experience was broad, including majors in English and in French Literature as well as in Mathematics, and courses in the History and the Philosophy of Math, I know that I can distill the beauty of mathematics and make it readily accessible to others. I hope to inspire in each student who crosses my path what Henry Wadsworth Longfellow called

The love of learning, the sequestered nooks,
And all the sweet serenity of books

thereby showing my students that mathematics is a passionate and creative activity as well as a tool for the furthering of human knowledge and achievements.