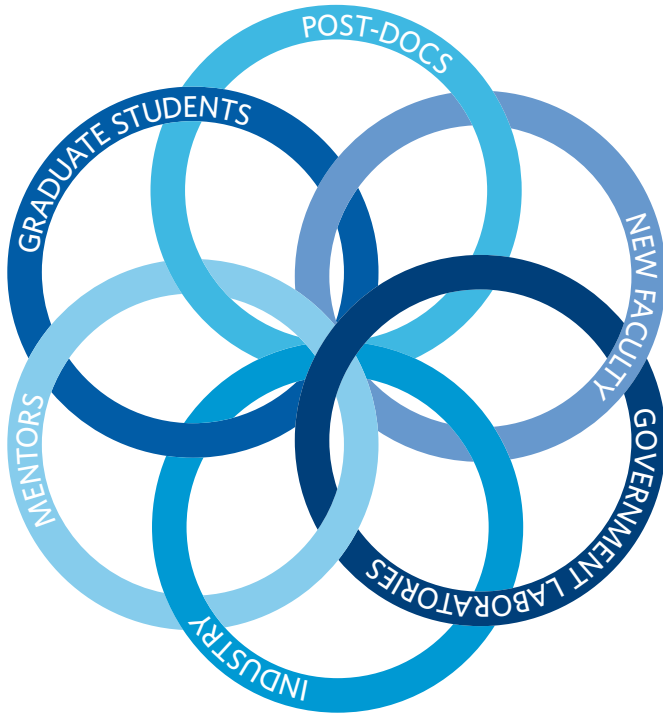


# EARLY CAREER

The Early Career Section is a compilation of articles that provide information and suggestions for graduate students, job seekers, early career academics of all types, and those who mentor them. Angela Gibney serves as the editor of this section. Next month's theme will be mentoring.



## Teaching

### Why Do We Teach?<sup>1</sup>

I'm serious. Let's have a talk about what we hope students get out of the classroom experience. Of course, it's a bit of a one-sided talk since I am doing the writing and you're doing the reading, but I do hope you will ask yourself this question and think about it as you continue to read.

Most often, faculty say, "I have a body of material that I want them to learn. My job is to get as much of it across to them as possible." Maybe it's multivariable calculus, and the goal is to teach them partial derivatives and multiple integrals. Maybe it's a first class on proofs, and the goal is to get them proficient in proof-writing. Maybe it's algebraic topology, and the goal is to teach them homotopy and homology. And teaching the material certainly is and should be a goal of every course.

But there is a second goal that to my mind is at least as important as the first. We want to impart a love of mathematics. We want to get across the power and beauty of the field. We want students to feel the same awe that we feel, for the "unreasonable effectiveness of mathematics." If we impart that to them, in whatever measure possible, then not only do they learn the material from the course, but they go on to take another course. And then hopefully another course. And their mathematical odyssey becomes a lifelong endeavor. They learn much more mathematics than just what was in that one course.

Steven Ceci is a psychologist at Cornell University. Having taught the same developmental psychology course every semester for twenty years, he decided to do an experiment. In the fall, he taught the course as he usually did, to a total of 243 students, only this time audiotaping the lectures. Then, over the winter break, he took a teaching skills workshop taught by a professional media consultant. The instructor worked with the participants on methods of conveying enthusiasm and excitement for the material: varying voice pitch, using hand gestures, trying to exude

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enthusiasm and connect with the audience through body language.

Then in the spring semester, Ceci taught the same course to 229 students. He did his best to replicate exactly what he had done in the fall, using the same book, same syllabus, same room, same time of day, same teaching aids, and the same exams and quizzes (which were not returned to the students in the fall semester). Before each class, he would listen to the audiotape of the corresponding lecture from the fall, and do his best to memorize it, which, having taught it for twenty years, was not that difficult. Then, when he presented the lecture, his only change was to follow the recommendations of the consultant and to show more enthusiasm.

Then Ceci and his co-author Wendy Williams examined the student course survey results for the two semesters. Questions were on a five-point scale, with 5.00 being the highest.

The most important measure of the success of the experiment was the question on the enthusiasm of the professor. In the first semester, Ceci received a mean score of 2.14, whereas in the second semester, he received a 4.21. So, the goal of conveying enthusiasm was definitely achieved.

But now let's look at the results for some other questions. On the question of whether the instructor was knowledgeable, he received a 3.61 in the fall and a 4.05 in the spring, which is kind of funny given that he was no more knowledgeable in the spring than he had been in the fall. But that's not such a huge difference after all.

On the question of whether he was accessible, he received a 2.99 in the fall and a 4.06 in the spring. That's in spite of the fact that Ceci states unequivocally that he was equally accessible in the fall and spring. For organization, he received a 3.18 in the fall and a 4.09 in the spring.

On the question of how much the students had learned, the average score was a 2.93 in the fall and a 4.05 in the spring. In fact, although the students believed they had learned more in the spring, the total number of points garnered on the exams averaged over each of the two semesters were nearly identical. Students in the second semester had not learned more.

Here's my favorite. The students were asked to rate the textbook. In the fall, they gave it a rating of 2.06 versus a spring rating of 2.98. The professor's more enthusiastic style of teaching influenced their appraisal of the book!

And perhaps the most important question in terms of the evaluation of faculty is the overall rating of the course. In the fall, the score was 2.50 and in the spring it was 3.91, a dramatic difference.

And finally, the last question, which is certainly also a critical one, is whether the student would recommend the course to others. In the fall, the score was a 2.36 whereas in the spring, it was 2.81.

Now, before reading on, you should ask yourself, what is this study telling us? What is the conclusion we

should draw? Go ahead, ask yourself, I'll go make myself a sandwich.... What? Done already? Well, then, I'll eat the sandwich later.

Let's first see what the authors say. Their conclusion is that the study is a clear indictment of the student course surveys and their use in tenure and promotion decisions. The fact that such minor changes in teaching style could so substantially impact the scores indicates that student course survey data is easily influenced by factors that do not translate into better learning, and therefore colleges should not use this kind of data in their decision-making processes. The scores are not measuring how effectively the faculty are imparting information.

But my interpretation is entirely different. Of these two groups of students, one in the fall and one in the spring, which are more likely to take a follow-up course? Which are more likely to want to continue their studies in psychology? Which are more likely to become lifelong learners in the field?

Unfortunately, Ceci and Williams did not collect that information. But I think we can both make an educated guess to the answer. When Ceci showed enthusiasm by any means possible, the students had a better experience in the class. They were more engaged. And one must suspect, they were much more likely to continue on to a subsequent course in psychology.

Quite a while ago, at the MAA MathFest conference in Seattle, Ed Burger and I put on a teaching workshop. The idea was to experiment with the latitude that we have in our teaching styles in the classroom. Too often, faculty are convinced there is a particular manner in which we should behave in the classroom, a "professorial demeanor" we should take on. We wanted participants to explore the bounds, experiment with the reality of how much leeway we actually have.

To that end, we asked all the participants to come prepared with a three-minute presentation on any topic in mathematics they wanted. Then before they began, we had them pick a small piece of paper out of a hat. On the pieces of paper were written instructions for how they should present the material. Some examples are:

- You are in a Broadway show, sing and dance it
- Your hands/feet are tied
- You HATE this math
- You're a used car salesperson
- You just won the Fields Medal and are very pleased with yourself
- You have twenty extra minutes, and must stretch the material out
- You really have to go to the bathroom

The presentations were amazing, and incredibly entertaining. We all laughed until we cried. But the point was not that we should now all act as if we were in a Broadway show. That could be ugly, at least in my case. Rather, the point was that we all have immense leeway in our teach-

ing style. We do not need to restrict ourselves and put on a professorial demeanor. In fact, that's exactly what we shouldn't do. We shouldn't teach the way Ceci taught that fall and the way he had been teaching for the last twenty years. Let your personality out. Let your enthusiasm out. You obviously went into math because you love it (you certainly didn't do it for the money). Let the students see your love of mathematics.

This is true if you lecture, if you flip your class, if you use active learning or inquiry-based learning. I will always believe that there is no one correct method for teaching mathematics. New ways will come and go, some good, some not so good. I urge you to ignore the people who tell you otherwise. It all depends on who you are and who the students are. Most important is to figure out what works for you.

I remember seeing a lecture by a professor who had won a variety of teaching awards. As I always am, I was curious to see what it was he did that made him so successful in the classroom. He gave a relatively standard lecture, but definitely well organized and clear. Okay, that's fine, but it's not going to win you prizes. There was only one thing he did differently that really stood out. During the entire lecture, he was grinning from ear-to-ear. It was clear for all to see how much he enjoyed the mathematics. He was in his element and everyone in the room could see and feel that. Of course, this doesn't mean that you should lecture with a grin plastered across your face. If it is not naturally you, students can tell, and you end up looking like a raving lunatic.

But we can each find our own ways to get across our continual amazement at the power of mathematics. And by imparting it to our students, we can create the next generation of mathematicians.

### References

Williams WM, Ceci SJ, How'm I doing? Problems with Student Ratings of Instructors and Courses, *Change: The Magazine of Higher Learning* 29:5, 12–23 (1997).



Colin Adams

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Author photo is courtesy of Colin Adams.

## Thoughts on Helping Students to Feel Included<sup>2</sup>

In this note I'll say a little bit about how a campus initiative at my institution, Mount Holyoke College, helped me understand issues that make students feel unwelcome in the mathematical community and what I changed as a result.

In the spring of 2017 the college canceled classes for a daylong conference dedicated to working together as a community to listen, brainstorm, and discuss diversity on campus. My colleagues KC Haydon (Psychology), Kate Ballentine (Environmental Studies), and Gary Gillis (Biology and Associate Dean of the Faculty) organized a session to discuss the experience of people of color in STEM courses on campus. Students and faculty broke out in small groups and talked and listened for a sustained amount of time. Responses to several prompts were returned to the organizers on Post-its, and a full group discussion followed.

I learned a lot by listening to the students. For example, it is important to our department that we provide lots of resources for students to get help. We have an evening help system where TAs assigned to specific classes hold nightly sessions where students are encouraged to work together. This is a free resource that was available to all students, but I hadn't realized that it was making some students feel even more isolated and alone. What I heard was that some students went with well-established working groups and other students came by themselves. The large groups tended to attract more TA help than isolated students. Even worse, walking into a room alone and seeing lots of students who already have working relationships was only reinforcing student doubts about whether they truly belonged in the class.

As a consequence of this I made two changes, one at the department level, and one in my own courses. At the department level, we made sure that our TAs are aware of this dynamic and how harmful it can be. We also implemented on-demand individual tutoring sessions for students. The TAs who are offering individual tutoring sessions work with the course instructor to determine times that make sense. Then the student TA sets up appointment slots on a Google calendar that the instructor shares with the class. Students can sign up for these slots, no questions asked. This allows students to get help when they need it without going through the instructor, which may feel intimidating or stigmatizing.

In my own courses I've become much more transparent with students about the pedagogical choices that I am making. For example, I used to do group work partly so that students would meet one another. Now I tell them explicitly that this is one of the reasons I have them work

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