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Race, Ethnicity, and the Scientific Enterprise

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University Faculty: Priming the Pump or Lying in Ambush?

There appears to be great misconception about the role of university faculty. It is *not* to communicate to students the technical aspects of our subject; our role is to communicate a point of view.

My comments are not meant to be universal but rather are directed to the mathematics community. I have spent most of my academic life in that insular cocoon called research. For me, the most wonderful aspect of being a researcher is that feeling of being totally lost, without a clue as to where the next idea is coming from. At times like these, a researcher goes through an agony. Should the problem be abandoned or pursued for yet another day? And then the fog lifts and we are flooded with those sought-after insights. Along the path we find obstacles, but persistence or inner strength allows us to continue. What joy! That is my point of view.

If these observations seem too focused on the discipline of mathematics, consider this: Suppose that we could increase to a flood the number of high school students who are interested in pursuing careers in the sciences, engineering, and mathematics. When these students arrive at college, they have to pass through calculus courses. And it is here that we manage to bore them to death. Can it really be that the subject is so dry and boring? Nothing could be further from the truth.

Mathematics is experiencing a flowering. The last forty years have seen some of the most important problems of mathematics being resolved. Centuries-old questions have fallen to the juggernaut of modern mathematics. But, as this juggernaut has pulverized the fortifications of countless problems, it also appears to have crumpled the career choices of many of our students. Yet, mathematics is basic to modern day society. The language of mathematics is used to phrase the basic laws of nature, to predict the movement of arctic storms across the continents, to model the flow of blood through our veins. Its importance is so pronounced that young people who are ignorant of mathematics will not be able to participate in today's technological world. It is an indictment of today's society that while mathematics has blossomed in our universities, our students are avoiding mathematics-based careers.

Some of the blame lies within our profession and with the social workings of our departments. Mathematics faculty must begin to talk to students. Among the various methods that I have used over the years, one rule of instruction is to spend one day in the semester presenting some aspect of mathematics that is not covered in the syllabus and that shows my own fascination and interest in mathematics. We should not be afraid to show the emotion we have for our subject.

All faculty should make it a point to have a personal conversation with their students, at least once during the semester. It doesn't take much: What are you majoring in? What courses are you taking? Have you been enjoying them? These are very simple questions, but few faculty members take the time to engage their students in even this rudimentary conversation. The tendency for faculty to distance themselves from their students may be an outgrowth of the cultural behavior we learned to gain entrance into the profession. It is time to change this behavior.

Over the years, I have tried various forms of interaction with students. Sometimes I require students to read and discuss with me some chapters from a book on the history of mathematics. The content of these readings often encouraged students to continue their studies in mathematics. Some activities go beyond casual conversations and are aimed at increasing the number of students, especially minority students, who choose careers in the sciences. The program might be described as aggressive advising. At the beginning of the semester I obtain a list of minority students enrolled in the calculus sequence, usually about 200 students. The students come in to see me, I go over their schedule of courses with them, ask them about career goals, and tell them about my own career goals and the many activities I am involved in. I may also tell them about some of the problems I have encountered in going through the system.

I try to impress upon the students how important mathematics is to their future and also mention the possibility of their becoming mathematics majors. This can be shocking to students who never realized that such a career existed, much less that they might have that option. The following are examples of typical conversations I have had with students.

Juana: I asked Juana the typical questions. Juana was taking first-semester calculus and first-semester chemistry during her second semester on campus. When asked what her major was, she said that she was undecided. I wrote down that she was a mathematics major. She said, "What!" I told her that anyone who is taking calculus and is undecided automatically becomes a mathematics major and I become their adviser. I took out the form that would make her a mathematics major and told her that I would fill it out later. She was a bit in shock. I asked Juana what she took during the first semester. She said calculus and chemistry but told me she had failed both courses. What happened? Well, Juana has a problem of procrastinating. It is hard for her to get going. She got a little sick last semester and then sort of gave up. How is this semester going? Procrastination was rearing its head again. I told her that she had two options.

> Option 1: I recommended several relatively easy courses she could pass without having to work too hard. If she wasn't going to decide to work hard, these courses would allow her to coast along in school for a while until she was able to make up her mind to start dedicating herself to work. In the interim, the university wouldn't kick her out because of bad grades.
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> Option 2: She could become a mathematics major with me as her adviser. I would work with her to develop a challenging program of study. Besides the mathematics courses that she would be taking, I would explore with her various other courses to determine where her interests might lie. I emphasized that my role was simply to be her adviser. It was up to her to make the decisions. If she did not follow my advice, I would not be upset. I would hope that she would continue to allow me to help in developing her program of study. I also told Juana that I lost lots of mathematics majors to other disciplines. Sometimes, during this process of exploring other areas, a student finds some other subject more to her or his liking. When this happens I feel that I have helped the student to find the right subject area and to take more mathematics courses than the average student. What could be better!

This conversation took perhaps twenty minutes. Would the average mathematician have had this conversation with a student who had failed the first course in calculus? Why not, if that student is courageous enough to try it. Would such a student go on to graduate studies in mathematics? Many mathematicians believe in their hearts that advanced mathematics is only for those students who have Ph.D. potential. If the student does not want to study mathematics for the sake of doing research in mathematics, then the professor is wasting his/her talent on that student. This I believe is a very typical attitude among my colleagues.

Wendy: Wendy is a first-year Navajo student who earned a 3.8 GPA her first semester. She wanted to study computer science. She had taken calculus and the first course in computer science during her first semester, and she was presently enrolled in second-semester calculus and the second course in computer science. Although she was doing well in her technical courses, she was earning a D in sociology 100. I advised her to drop it. She told me that she would lose her scholarship from the Navajo nation if she did so. I disagreed with her. Then she told me that her mother would not be happy with her if she dropped a course. She said that her mother had recounted a story about one of her cousins who had dropped out for a semester and had never

returned to college. I told her that I did not want her to drop out of college, only to drop this one course so that the grade would not adversely affect her GPA. I offered to call her mother right there and then and explain why I was recommending that she drop the course. As to her scholarship, I told Wendy that I would call the Navajo nation to find out exactly what the rules were. After speaking with the administrator, I made certain that Wendy understood the rules that would allow her to make a decision.

This meeting left the student with the feeling that a faculty member at this large, impersonal university actually cared about her academic progress. She later asked me to advise her roommate, who is also from the Navajo nation. I told her that I would be delighted to see her.

Before the student left, I explained that she could become a mathematics major and still study computer science if she became disheartened with her computer science curriculum. I am very aggressive about encouraging students to choose mathematics for their major, not because I am interested in having them become mathematicians but because I care about their welfare. As their adviser, I have the opportunity to work with them. These efforts are showing results. In 1993–94, I had six Hispanic advisees graduate with bachelor's degrees in mathematics, and the next year eight more; in 1995–96, I expected another ten such students. This last group included one African American student and one Yaqui student—the first member of the Native American nation that resides in Southern Arizona and Northern Mexico to receive a degree in mathematics. I now have thirty-five minority advisees in mathematics.

I would like to make the following recommendations to mathematics faculty:

- It is the responsibility of mathematicians to convince the community of the necessity of studying mathematics.
- Departments have to find a way to evaluate and encourage good teaching and good outreach efforts.
- Many research mathematicians believe that advanced mathematics is useful only for those students who want to pursue careers as mathematicians; professional mathematicians also need to be educated about the discipline's usefulness.
- Precollege teachers attend in-service workshops to increase their knowledge of the field. Such methods might be applicable to our university communities. It would be an opportunity to communicate the knowledge we create. It is here that we need lots of in-service help.
- Let's talk to our students. Our contact with students should serve to motivate them to further studies.

We, as a community of scholars, should begin placing as much emphasis on communicating mathematics as we do in creating it. If we are willing to take taxpayers' dollars to support our studies, we should also be willing to give their children the desire to be mathematically literate. It really is in our best interest to do so.