My View

Studying Science:

A Level Playing Field?

by Angela Johnson, Assistant Professor of Educational Studies


Photo by Wrenn Heisler '99

As a woman of color, Bessie Mbadugha, assistant professor of chemistry, is the exception to the rule in the sciences. Her interest in chemistry began as a child. "In the ten years that I grew up in Nigeria, I was quite fascinated by the traditional remedies that worked wonders in curing ails," she commented. She wanted to know why these remedies worked—and turned to science for answers.

I began my career teaching high school physics in Arlington, Virginia, in a profoundly diverse school. There were as many as 55 different languages represented and no majority race. I taught students who had survived the Khmer Rouge, fled from Viet Nam on rickety boats only to be attacked by Thai pirates, slipped out of Iran with only what money they could conceal in the hems of their coats, survived the famine in Ethiopia. I had a student who was a former child soldier and a student who came from such a remote part of the world that he was a polio survivor.

Besides the insights you might expect a young teacher would get out of this setting—the miracle of our universal humanity, the fragile diversity of culture—what these students really led me to think about was the redemptive power of science.

Science can do two things for students, particularly students who have been dealt a difficult hand by life: it can bring them prosperity, and it can bring them peace. For students from disadvantaged families, science—particularly physical science—is a more level playing field than other disciplines. For new speakers of English, for example, physics and chemistry can be understood through their knowledge of algebra. I taught students who succeeded in class by following equations from the board months before they were following my words. For many of these students, science was a route into dignified, well-paying careers that provided help to their poverty-stricken families.

The study of the natural world, in all its symmetry, predictability, and demanding complexity can also bring solace to students. I, too, still turn to physics when I feel troubled—its immensity and its intangibility are more reassuring than any human comforts. Within the rigor of hard work and careful thinking that science demands, students can find unity, stillness, discipline, and contentment. As my students worked together on labs and problems, calm would sometimes descend on us all; they were in flow—they had forgotten themselves in the pleasures of intellectual engagement.

I understand science's power to enhance people's lives. So, it was disheartening when I figured out that some students had more access to that betterment than others. I realized that my Advanced Placement (AP) classes were far more diverse than the national average, and were 50% women. But in a school where white students made up only 10% of the population, my classes were 50% white. I couldn't just blame this on "gate keeping" in the introductory physics class: I taught that class, too.

Eventually, in a decision I still question, I quit teaching physics to pursue a doctorate in educational anthropology. I wanted to know why schools work so much better for some kinds of students than others. Why does student success, especially in science, seem to be predicated more on externals (race, gender) than on interest or even ability? It is ironic—so many scientists were instrumental in debunking the biological basis for racial distinctions! Further, most of the scientists I know are passionately anti-racist and anti-sexist.

After almost ten years studying this issue, I've found that the explanation for the discouragement of women and of black, Latino, and American Indian men from the pursuit of science is much more subtle. Much of it lies in the varying meanings different kinds of people take from similar incidents, institutions, and interactions.

My dissertation investigated the lives of 20 women of color who majored in science. I examined their lives and career goals, their reasons for liking science, their experiences in science classes and labs, and the meanings they made of those experiences. I found two surprising things.

> *"Why does student success, especially in science, seem to be predicated more on externals (race, gender) than on interest or even ability?"*

First, the problem of under-representation of women in the sciences is often conceptualized as a "leaky pipeline"—too few women enter it, and too many leak out at important transition points (high school to college, college to graduate school). Our solution to this tends to focus on encouraging more women to enter science, so I had expected to find women with a somewhat weak natural interest. Instead, my study told me they were majoring in science because *they* liked it and felt they were good at it.

The second surprise was that the women almost universally told me that they wanted to pursue altruistic careers: they wanted to devote their professional lives to the service of humanity. For them, science was intrinsically linked to altruism, but they found little support for this view in their science classes. Professors tended to shape all their interactions with students around *science*, which seems reasonable except that many in my study, with their values of service and relationships, felt it was alienating. They thought their professors "didn't like" them, though I saw something quite different. I saw professors who cared for their students and shared with them their passionate understanding of their field.

There is another common misunderstanding between science professors and minority students, particularly students who have come from inadequate high schools. Most of the professors I have spoken with about the low numbers of students of color in science classes assume that this is due to inferior academic preparation. And though it is uncomfortably true that black, Latino and American Indian students are woefully served by our public schools, I think this explanation is incorrect in many cases.

Often, the students of color who wanted to major in science were the best students at their respective high schools; some of these students made it to college despite great obstacles. They have the motivation and ability to be successful. However, when they get low grades on tests in introductory college science classes, instead of interpreting these scores as indications that they need to study more and better—they see them as a sign that they have low *ability* in science. Because many introductory science courses have traditionally been used to "weed" less able students out of science, these high-ability, moderately unprepared students are unwittingly *selecting themselves* out of a field in which they actually could succeed.

Inadvertently, a pool of interested, able science students is being discouraged from the pursuit of science regardless of the best intentions of both students and instructors. Despite the redemptive power of science, despite its comforting neutrality, it is practiced by humans—and we are imprecise. The way to understand dynamics like these is through examinations of meaning, assumption, and what just seems natural to people. Luckily, scientists, with their carefully trained minds, are particularly suited to studying these questions. I am hoping for an answer, for I wonder what insights we lose with every student who, discouraged, gives up on majoring in science.