

The Inner Scientist

Reaches Out

by Amol Punjabi

When I was in eighth grade, my best friend's parents entered him in a lottery for admission to a STEM-based charter high school. There had been a lot of political talk about a STEM education deficit at the time, but it wasn't until I looked up the facts that I understood why.

While people in STEM-related jobs earn 26 percent more than those in non-STEM professions, between now and 2018, 2.4 million jobs are expected to go unfilled because of a lack of qualified applicants (Source: U.S. Department of Commerce, Economics and Statistics Administration). I also learned that there is a yawning gap for gender and ethnic minorities in STEM fields: According to the National Center for Science and Engineering Statistics, 73 percent of U.S. scientists are male; 70 percent are Caucasian.

Science World

Both of my parents occupy STEM professions, so I had the opportunity to be immersed in science early on. Over the years, I've pursued my passion for materials science and biochemistry through scientific research at home, in school, and in the lab. When we were younger, my brother, Rahi, and I loved to do fun science activities with others and teach them along the way. We even created Science World, a corner of the basement where we organized supplies for these activities so they would be ready for the next "guest"—usually an unsuspecting family friend or member of our Cub Scout troop. Teaching others a subject we love may have begun as a now-embarrassing, attention-seeking pastime, but after tutoring students in elementary and middle school, it became much more. Helping someone understand a scientific concept fulfills me like no other form of service.

After learning about the need for qualified STEM professionals and the low number of minorities in STEM fields, Rahi and I decided to revive Science World in a more meaningful way. At our local Boys and Girls Club, we created a STEM enrichment program for students in grades three through five aimed at bridging the gap between under-

served minority students and science. We called it Science for Shooting STARS (Science, Technology, Applied Research).

We wrote our own teaching slideshow with the goal of making concepts in cell biology easy for a third grader to understand. We limited "chalk talk" to 10 minutes to allow the 20 students to do hands-on experiments, such as extracting DNA from strawberries and making an edible cell model. We were delighted when the students not only understood the concepts, but were interested in our discussion of how scientists are manipulating DNA in the fight against cancer. It became my goal to help them grow up to become pioneering scientists.

The Value of Questioning

Despite late-night PowerPoint rehearsals and overnight Amazon orders of hydrogen peroxide and citric acid, Rahi and I gladly returned 10 times that year to engage the students with activities that included synthesizing polymer slimes, recrystallizing minerals, and germinating kidney beans. Each week when we walked in the door, the students would eagerly form a line to climb the two flights of stairs to the "science room."

As they learned to apply their knowledge to solving the puzzles behind experiments, I became a better teacher. I learned to ask questions instead of providing answers. When I demonstrated a burning dollar during a thermodynamics lesson, rather than explaining that the trick was coating the bill with alcohol, I guided the students with questions: "If the dollar bill didn't burn, what did?" "What things do you know from the kitchen that burn and are liquid?" I was amazed at their energy as they searched for the answer. I realized that this was real learning.



Amol demonstrates the thickening of a polymer slime at the Tri-Town STEM Expo.



Rahi gives a food science lesson at the South Middlesex Opportunity Council Childcare Center.



Students from the Cambridge Boys and Girls Club visit the Koch Institute for Integrative Cancer Research at MIT. On the walls are microscopic images of cancer cells.

While the science fair was the pinnacle of my dreams for Science for Shooting STARS, I knew there were hundreds of other kids who could benefit from the program. Last year, Rahi and I contacted friends we'd met at various science events from Boston, Worcester, Medford, and other towns in Massachusetts to see if they were interested in sharing their passion for science. Ultimately, we recruited 23 high school students to form a team of STEM educators that would take the program across Massachusetts.

Bridging the Gap

After standardizing our lesson plans, raising over \$2,000 for materials through grants and fundraising kits, and preparing teaching kits for each region, we harnessed the power of Facebook, Skype, and Google Apps to bring the monthly program to 16 Boys and Girls Clubs, federally funded childcare centers, and inner-city elementary schools.

We ended the school year with the first statewide elementary school science fair. At my high school, over 100 students presented their projects to judges and each other. I could see the seeds of scientific collaboration germinating among the participants. The science fair had begun to bridge the educational gap for these students who, when given the opportunity to pursue answers to their questions about the world around them, had begun to enjoy science.

To date, we've reached out to 500 students, most of whom represent gender or racial minorities in STEM fields. But Science for Shooting STARS is about more than service; it's a lifestyle that incorporates my love of science and community and my entrepreneurial spirit.

One more thing: when third graders get a kick out of a Mentos geyser, my inner scientist does, too. ■

Becoming Scientifically Literate

Science for Shooting STARS may have started as a Bill Nye knockoff, but I knew we could make it unique if we brought STEM learning to a real-world, inquiry-driven level. I spearheaded a science fair program in which Rahi and I mentored student research groups as they applied the scientific method to their own questions. Just as scientists had mentored me in my science fair projects since seventh grade, from January through May I watched "my" students learn to ask questions about the world around them and figure out how to answer them. Even if they didn't become scientists, I knew that the problem-solving skills they were learning are important to any job—and to managing the obstacles of life.

Despite snow days and a few experiments gone awry, everything came together in June when we held the first-ever elementary school science fair in Massachusetts. In the Boys and Girls Club gymnasium, 30 students proudly displayed their posters and demonstrated their experiments for parents, teachers from my school (who acted as judges), and the media. When the judges asked one student why hot water dissolves Alka-Seltzer tablets faster than cold water, she explained that the hot water causes the Alka-Seltzer molecules to move apart faster. I beamed. She had pieced together the correct answer using the principles she'd learned in our thermodynamics lesson. The student had acquired more than factual knowledge; she was demonstrating scientific literacy.



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