

The Intersecting Lives of Two Mathematicians in East LA

In March 1996, a telephone call from a young woman was transferred to my office. “My name is Erika Camacho,” she said confidently. “I applied to your summer research program and want to know if I will be accepted. I have several offers but I really want to come to your program.” I was surprised

Expanding our Scope

By Carlos Castillo-Chavez

at her strong interest in a program that had just been established and therefore had no track record. But Erika had done her homework. She knew that the program’s objectives were to broaden participation in the mathematical sciences. Her goals in life, as a junior mathematics and economics major at Wellesley College,

were to help others like her, but she wasn’t sure if she could best do this on Wall Street or as a high school teacher. The program Erika was inquiring about—an undergraduate summer research experience at Cornell University—had been cooked up only a few months before, on the encouragement of Bill Velez,¹ president of the Society for the Advancement of Chicanos and Native Americans in Science, or SACNAS. The creation of this program has been the most fulfilling and rewarding chapter of my life as a professor.²

With my answer to Erika, “Yes, you are in,” we admitted our first student. That year, we had more than 160 applications. We took 36, which turned out to be the largest group of undergraduates ever admitted in a single summer. Erika’s credentials clearly put her at the top of the group, and her personal statement introduced me to the obstacles that she had overcome in becoming the first member of her family to attend college.

Erika arrived in Ithaca, New York, in the summer of 1996, determined to learn everything she could and change the world. Born in Mexico, she never met her dad, who died in a car accident when she was three months old. In a country lacking adequate support networks, this tragedy pretty much guaranteed her a life in poverty. Her mom, who had not completed elementary school, remarried when Erika was seven years old, moving with her four children to East Los Angeles in 1982. In 2003, Erika received a PhD from Cornell University; the day of her graduation, I asked her what kind of future she thought would have waited for her in Mexico. Her reply was immediate: “I would have been a maid, working at somebody’s home.” How did Erika get from an unpromising start in Mexico, followed by a life riddled with danger in East Los Angeles, to her current position as a professor at Arizona State University? The concise answer is: *Jaime Escalante* and *ganas*.³

Millions of Americans, including me, were introduced to Jaime Escalante in the 1988 film *Stand and Deliver*. In the film, Edward James Olmos, a Chicano actor, portrays Escalante, magically capturing his personality, inspirational mentoring style, and passion and confidence in his students.

Escalante, a high school mathematics teacher, single-handedly transformed Garfield High School, an inner-city school in the middle of an unsafe neighborhood, where Erika was a student. In her words,

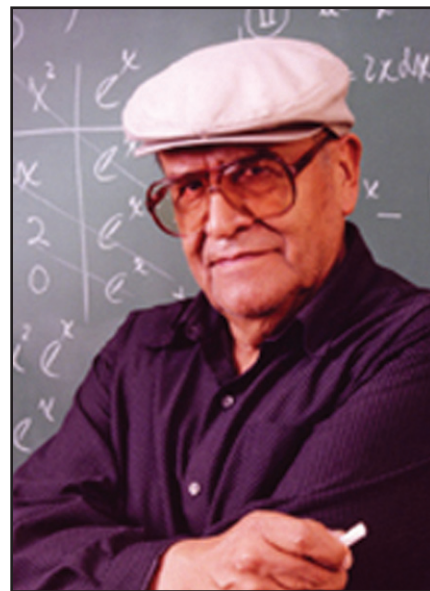
“Living in East LA was rough and scary at times but it was all I knew. Many of my good friends from middle school and junior high ended up pregnant, dead, or in juvenile hall before even getting to high school. Nearly every weekend there was a shooting or a stabbing. It wasn’t until I left East LA to attend Wellesley College that I realized how rough East LA really was. I just assumed that it was like that everywhere.”

Garfield High School under Escalante became the model inner-city high school at which mathematics achievement is the norm. How did he do this? Escalante did not know the meaning of the word “remedial.” His philosophy of shooting for the stars regardless of a student’s initial conditions is indeed the material of which Hollywood movies are made.

Jaime Escalante, or “Kimo”⁴ as his students called him, operated under the assumption that young people, especially his students, could never be anything but successful. “All you need is *ganas*” was his motto. Escalante’s genuine belief in the infinite potential of young people and the proof that he provided via the high level of mathematical accomplishments of his students drastically altered Erika’s original plan of becoming a cashier. As she puts it, his pedagogy/mentoring was based on a Latino version of tough love:



Born in Mexico, schooled in East LA, where she had the good fortune to learn mathematics from Jaime Escalante, Erika Camacho is now an assistant professor of mathematics and a mentor and role model for students at Arizona State University.



Jaime Escalante, 1930–2010. Photo courtesy of Michigan State University.

¹William Yslas Velez, a professor of mathematics at the University of Arizona, has made monumental efforts to improve access of underrepresented minorities to undergraduate mathematics education. As a result of his efforts, the number of mathematics majors at the university has nearly doubled in the past few years.

²For details, see C. Castillo-Chavez and C.W. Castillo-Garsow, *Increasing minority representation in the mathematical sciences: Good models but no will to scale up their impact*, in *Doctoral Education and the Faculty of the Future*, Ronald G. Ehrenberg and Charlotte V. Kuh, eds., Cornell University Press, Ithaca, New York, 2009, 135–145.

³The Spanish word *ganas* means desire combined with a commitment to do one’s best.

⁴The students’ use of “Kimo” comes from the Lone Ranger’s nickname “Kemo Sabe.” It is no accident that the Spanish word “sabe” means “knows.”

“For example, I remember saying ‘Kimo, look—I got it! I know how to do this problem.’ His response was ‘Great! Now do these two more before you forget how to do this type of problem’ with a smile on his face. However, when I replied ‘Are you serious?’ he responded, ‘Absolutely,’ as he handed two more problems for me to do. As I was saying ‘It is not fair,’ he stopped me right away with the words ‘Stop wasting brain power by complaining; now you’re making me think that you just got lucky and that you really don’t know how to do these problems.’ ”

Frustration was also handled in the Latino way, Erika recalls:

“Kimo heard me from across the classroom: ‘I can’t do this,’ while I was putting my pencil down. The message in a loud and clear voice was ‘Esta mensa (an affectionate word for dummy⁵) is giving up so quickly . . . she is not ready for this class . . . maybe she belongs out there with all the other mensas memorizing cheers.’ I was a cheerleader at the time. Kimo started jumping up and down, kicking, and pretending to be a cheerleader. It was funny. I was laughing but at the same time I was so mad and embarrassed. . . . I told myself that I would show him. So I picked up my pencil, thought hard and eventually I was able to do the question . . . Kimo said with a smile, ‘You are not just a cheerleader—you are smart.’ ”

Escalante was deeply upset when the success of all his Latino students at Garfield High School was presumed to be the result of collective cheating on the AP Calculus exam, but his indignation re-energized him. He was not at all surprised a few weeks later when, after taking the exam a second time under strict supervision, all the students passed. Escalante proceeded to repeat this AP success over and over at Garfield High School with successive generations of students—a point to consider as we lament the shortcomings of our K–12 educational system.

One of the lessons to be drawn from Escalante’s story is that he worked with the students he had, never putting the blame on public elementary or middle schools. Most students whose lives he touched became successful in a school where successes in the mathematical sciences were previously rare. His achievements were due to his inability to see his job as a nine-to-five commitment as well as to his use of positive culturally driven expectations. Erika makes this clear:

“Kimo gave a lot of his time before and after school, tutoring every day, holding weekend math sessions and summer school sessions. He worked hard and expected a lot from each and every student. Kimo repeatedly reminded us when we were stuck on a problem that math was in our blood since our ancestors were the Mayas—he would often say ‘You burro, your ancestors were so good in math that they even developed the concept of zero . . . and you don’t know anything, what a shame. But you can make them proud—take the chalk and show me that you can make them proud.’ ”

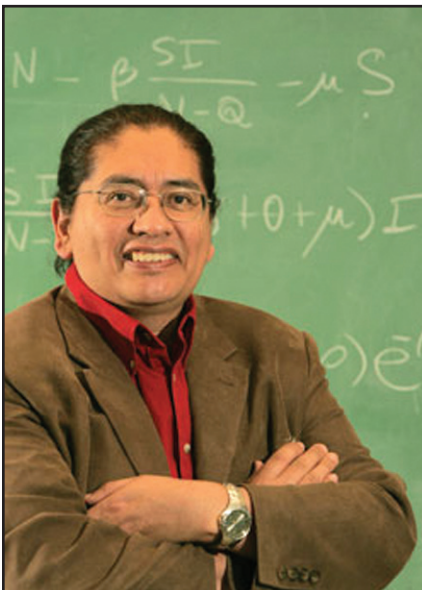
In a recent nationally televised CBS News story,⁶ we learned that Jaime Escalante was battling cancer and that he had run out of funds to pay for treatment. The words that Escalante the gifted teacher used to characterize his fight to survive just a little longer encapsulate the inspirational impact that teachers can have on the young and the old: “It is not how many times you fall down. It’s how many times you get up that you count.” Escalante’s former students, Erika among them, rushed to his assistance. On March 30, as we were preparing this article for publication, we received the sad news that Escalante died that day.

Erika’s deep and profound admiration for “Kimo,” highlighted in the CBS segment and in several news articles around the country,⁷ reveal a fact that cannot be ignored: Jaime Escalante was one of the luckiest people in the world. He did what he loved the most—mentor young people—and he did it as well as anybody ever has. He saw the fruits of a life lived with passion, intensity, and commitment transform the lives not only of his students, but also of those who have been touched by his students.

The 79-year-old Escalante was an inspiration to Latino children around the nation, including my own. Through Edward James Olmos’s powerful portrayal of Escalante’s mentoring skills, faith in the unlimited potential of students, and integrity, *Stand and Deliver* and the contributions of his thousands of students and their descendants will continue to impact the lives of young and old, regardless of their ethnicity, for generations to come.

Halfway through the summer research program at Cornell, Erika decided that she wanted to pursue a PhD; the first alumna of the program, she was also the first to be admitted to Cornell’s applied mathematics program, in which she worked under the supervision of Richard Rand. Six years later, accompanied by her family and 3-year-old son, Erika received her PhD in mathematical biology. After holding a postdoctoral position at Los Alamos National Laboratory, this dropout cashier joined the mathematics faculty at Loyola Marymount. She is now mentoring students and inspiring Arizona State University communities as an assistant professor of mathematics in the Division of Mathematical & Natural Sciences in the New College of Interdisciplinary Arts & Sciences. Her story shows that the American Dream is alive but that the achievement of it depends on the availability of role models of all types in our diverse society. Erika’s success supports our strong belief that the future does not hold two Americas—a belief that we can affirm only via our systematic efforts to broaden participation.

Websites related to Jaime Escalante: <http://edwardjamesolmos.com/>; <http://www.edwardjamesolmos.com/Jamieescalante/main.swf>.



Expanding our Scope is a new column devoted to stories that highlight the efforts of individuals to broaden participation in the mathematical sciences. Carlos Castillo-Chavez, Regents Professor and the Joaquin Bustoz Jr. Professor of Mathematical Biology at Arizona State University, is the editor of the new column. He welcomes submissions and ideas for future columns (chavez@math.asu.edu).

⁵Intonation being the key.

⁶<http://www.cbsnews.com/video/watch/?id=6267948n&tag=related;photovideo>.

⁷<http://www.statepress.com/2010/03/09/asu-mathematics-professor-from-low-income-1-a-high-school-excelling-in-ariz/>; <http://www.cbsnews.com/stories/2010/03/04/eveningnews/main6267789.shtml?tag=mncol;lst;2>.

Learning Math Opens Doors

“Since when does *SIAM News* have a movie column?” Hirsh Cohen wondered back in 1988 when *SIAM News* asked him to review the feature film *Stand and Deliver*. A former SIAM president (1983–84), Cohen, who is now retired, was then at the IBM T.J. Watson Research Center.

He saw the film, as we were pretty sure he would, and sent an enthusiasti-

cally perceptive review to *SIAM News* shortly afterward.

“You don’t learn how to do multiple integrals for the price of a ticket,” he wrote. “What you do learn is . . . It takes dedicated, knowledgeable, inventive teaching. Learning anything changes people; learning math makes a big change—it opens minds and opens doors.”

The 1988 review appears below.

From *SIAM News*, Volume 21, Number 4, July 1988

It’s the Teacher that Counts

By Hirsh Cohen

I went to a movie the other night. Like you, I don’t go regularly. I had my dose of Hollywood long ago on Saturday afternoons at the Uptown on the west side of Milwaukee. And, anyway, since when does *SIAM News* have a movie column? I’ll tell you when—when the movie is about CALCULUS. That’s right, high school CALCULUS. How to do it, how to teach it, how to learn the sweet taste of success and discover the gateway to a better life. I’m not talking about a classroom hand-held video or a PBS early morning documentary. A real movie movie. I think it’s a first for CALCULUS. There are no credit lines, but Isaac Newton gets a verbal cameo appearance.

As you have probably heard or seen, *Stand and Deliver* is the story of a dedicated, almost saintly, high school math teacher at Garfield High School in Los Angeles. Garfield is 98% Hispanic, and the students are primarily Mexican-American. The teacher, Jaime Escalante, converts a gang of 16- and 17-year-old animales about to begin life at the bottom—in hard work or hard crime or dissolution or all three—into calculus scholars. In the course of the film, the *animales* turn out to be individual boys and girls with hearts, souls, humor, and brains.

It’s a pretty good movie. No academy awards, a decent box office. But, let me tell you, in over 55 years of sometime movie-going, I’ve never seen a movie that co-starred *CALCULUS*. It’s true, really. You don’t learn how to do multiple integrals for the price of a ticket. What you do learn is:

—Almost anyone can learn math, even CALCULUS.

—It takes dedicated, knowledgeable, inventive teaching.

—Learning anything changes people; learning math makes a big change—it opens minds and opens doors.

Professional applied mathematicians know all about these things. Or they think they do. We’re now deluged with the Japanese mother legends. Japanese mothers believe their kids can learn if they go to school and work very hard. American mothers believe that you have to have a knack for mathematics (or biology or chemistry), that it’s not something everyone can do. There are a lot of other legends abroad, about computers in kindergarten and better curricula. But the real legends are the great teachers.

All right. There is at least one great teacher in Los Angeles, and he’s shown that teaching does make a difference and CALCULUS has made it to the movies. What’s all this got to do with applied mathematics and its practitioners? I’ll tell you. We need those minority kids—blacks, Hispanics, American Indians, and others—and we need all of the young women who don’t do mathematics and science. You know very well that there aren’t enough students coming our way—undergraduate or graduate. You also know the frantic forecasts of the demographers—a decreasing number of college students and a rising fraction for the college-age cohort of minorities, coupled with a decrease in the number of minority students (already small) who go into mathematics and science. You know that there is a long and hard filtering process that delivers only a few at our doorstep, the few who discover applied mathematics, sometimes through a great teacher and sometimes by sheer luck. So, we have to do all we can to get the best coming in our direction. Taking the AP calculus course, as Jaime Escalante insisted could happen at Garfield High, is a start. Getting the answer to “But what’s it for?” (the kids from the Garfield class visited the computing center at a local high-tech company when one of them asked that question) early in life is vital. A chance to learn mathematics and science or other applications *together* from teachers who are interested and know how to describe the relationship is still another necessary component.

I am not sure I know you all well enough to recommend *Stand and Deliver*. It has, by the way, the other necessary ingredient—the establishment villains in the high school math department and the Educational Testing Service, the poor quality of most teachers, and the practice of having non-trained people teaching math. But the key message is that good teachers are vital, and the movie really delivers that message. Good teachers make the difference, more than curriculum and computers.

How can we play a role? Here’s an idea. Each applied math group in the universities and in industry adopts a school. Not the kids but the math teachers. Amongst them there will be some fine ones. Help them to understand where math is being used by you and by industries all over the world. Not many of us can teach children, but we can become an important resource to the teachers. If we could give them the courage to continue to learn, to come to some of our seminars and colloquia, I’m sure they will know how to pass it on. If we could start our own tradition of helping in this fashion, it would eventually help us in our own needs.

Hirsh Cohen, consultant to the director of research at the IBM T.J. Watson Research Center in Yorktown Heights, New York, was president of SIAM in 1983 and 1984.

Disappointing Statistics

The American Mathematical Society reports that only nine of the 732 recipients of doctorates in the mathematical sciences in the academic year 1984–85 were members of the target minority group (Mexican-Americans, mainland Puerto Ricans, and American blacks). For 1985–86 the figure was 11 of 756. These figures are disappointing not only because the percentage of minority PhDs is so low, but also because the percentage has stayed the same declined for the last 30 years or so.

Update: According to the AMS, there were 1430 recipients of doctoral degrees reported for the academic year 2008–9. Of these, 669 were U.S. citizens, identified by race/ethnicity as 4 American Indian or Alaskan Native, 44 Asian, 19 black or African American, 19 Hispanic or Latino, and 1 Native Hawaiian or Other Pacific Islander.