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Y MATH + SCIENCE?

STORIES FROM YOUNG PEOPLE: A MONOGRAPH FOR YOUTH PROVIDERS

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www.InnovateCalifornia.net

Why learn math and science?

It is a fair enough question that we have all asked ourselves in the middle of a difficult class. In this monograph, we have answered the question by interviewing young people who are now either working or in college, and who use math and/or science in their jobs. We think that these are interesting stories, and that they may help you see why students should stick with these subjects.

Much has been written about the competitive advantage China, India and many European countries have compared to the United States because of the numbers of students graduating with strong math and science skills. Much has also been written about the new economy, and how jobs now and in the future will require more and more technical education and training. New programs, initiatives and websites are being created to encourage more young people in the US to take math and science. In California, policy makers are working hard to increase the importance of STEM (Science, Technology, Engineering and Math) education in our schools and colleges. The WIRED initiative in California has convened business and education to develop new strategies for increasing the talent pool for California's existing and emerging high tech industries. One important question for California, however, is how to entice young people who may have dropped out of school, or are at risk of dropping out, into studying subjects that they may not be interested in or prepared for.

This monograph is intended to be used by agencies and organizations that work with youth, as a tool to help communicate directly to youth from their peers. Inspired by Facebook and MySpace pages, we documented the interviews in varied ways and included personal information about these smart and hard working young people. We are working on moving these and other stories to a website in the future, so that others can add their stories as well.

We would like to thank all of the young people who gave us the time to interview them, and the Workforce Investment Boards who provided us with the names of people to contact. We also want to thank the California Space Authority, which provided funding for this monograph through the WIRED grant.

Our interviewer for this monograph is Mindy Musch, a recent college graduate. This is what she says:

"In high school I loved science and I was curious about everything: anatomy, physics, chemistry, biology. But when it came to math I only took what was required of me. Like so many others, which I have recently discovered, I wondered: why take all of this math? When will I ever apply what I have learned?

The answer for everyone is different. So many of us learn too late why we should have been paying attention in math or science, but that does not have to be you.

Here is a group of profiles of people who apply the math and science they learned in school to really exciting jobs. In almost every interview, from a wide range of people, I was told the same thing. 'I invested a lot of time to doing math and science homework,' It turns out that even those kids that I thought were just born math smart weren't. It takes everyone a long time to learn math and science concepts and the number of hours that were put in to studying is directly correlated with how well a student does in these courses.

The profiles are from all age ranges, a variety of different jobs, and with all different backgrounds. Some people learned their job through the military; others through a community college or technical program, and some attended or are attending universities. They all have one thing in common; they are excited about what they do. Their time spent studying pays off because now they get to be paid for doing things they enjoy. They all have stories of when that terrible question – why math and science - was answered for them. Some say it was when they started working on something that was important, others say it was when they saw all their skills working together to build or create something. ***The encouraging is that there is a reason for learning all that math and science.*** *"*

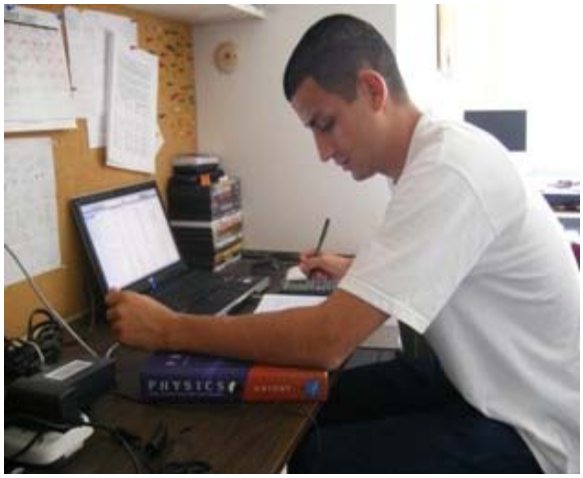
Career or Job	Algebra 2	Chemistry	Computer and Technology Skills
Auto mechanic	X		X
Chef	X		X
Computer programmer	X		X
Dental hygienist	X	X	X
Firefighter	X	X	X
Forensic technician	X	X	X
Graphic designer	X		X
Hairstylist	X	X	X
Information Technology (IT) specialist	X		X
Medical lab technician	X	X	X
Musician	X		X
Printer	X	X	X
Real estate agent	X		X

source: www.hsd401.org/studentfamily/career/mathandscience.htm

Did you know…that a majority of workers who earn at least $40,000 a year took two or more high school math classes in algebra 2 and higher?

Who is Milan Arellano? He went to high school in Arvin, CA which is a rural agricultural community. At age 20, Milan is working on his B.S. in Engineering with a minor in Math at Cal Poly San Luis Obispo. He still is not directed in a specific major, but is sure of his interest in engineering. So far he has talked to an advisor, taken a personality test and has discovered Industrial engineering- He likes it.

For his degree, Milan is studying a heavy workload of Math- Calculus and Science: Physics, Chemistry, and Biology.



What he remembers from High School- Milan struggled with math he did not put a lot of effort into it. He now says that he studies a lot. “Do it over and over until it is easy,” he says. Milan looks back at high school now and wishes that he would have applied himself more. He had a lot going on in high school with: sports, debate team, and other extracurricular activities. He has now learned to manage his time better.

What drives him Milan wants to make something of himself. Where he grew up wasn’t the best place. Milan saw people around him not doing anything with their lives, and he watched his parents struggle as he grew up. Milan works hard now, because his parents have worked so hard to get him to where he is today. “If I just stopped studying it would be a slap in my parents face. I want to do something great with my life and make my parents proud.”

Work experience In high school he had the opportunity of an internship. He worked for Transforming Local Communities, Inc.; while he was there he did a lot of statistical analysis and program evaluations.

Next Steps, Milan is now looking for an internship or a job shadowing opportunity in Industrial engineering. When he gets one he will be doing project evaluations and such. While evaluating projects he will be using the math and science that he is learning now in college. The Science will also play a role in determining what substances are capable of making things work more efficiently.

Free-time! Milan is a homebody; he likes to travel home to be with his family. “Sleep sounds pretty good right now,” Milan said. He also enjoys playing basketball and seeing and experiencing new things.

Education and Background Greg Sims is 48; he has a fascinating and rewarding job as an Associate in Manufacturing Cell Culture Operations at Amgen, Inc. in Fremont. He secured this position by taking a risk and attending the Ohlone Biotech program. Greg needed to be retrained after a job related injury; he had previously been an operator at an oil refinery. It was a risk for him because he attended the training with no pay and no promise of a career afterwards. Greg says, "You either trust the process and have faith or you don't!"

Manufacturing Cell Culture Operations Greg uses basic lab math and formulas. Greg describes a day at work, "In our GMP environment, we perform tasks that include manipulations and adjustments to bioreactors, stationary and portable vessels which requires documentation that is error free; the first time. Some of that documentation takes basic math skills but also sample taking, sterility of vessels, cleaning, pressure testing. The most important element is accurate step-by-step documentation. Our motto is: '…if it's not documented, it didn't happen.'"

Is there a career path for him to follow? "Career paths are well defined." There are specific learning plans and measurable goals that are monitored and tracked by Amgen, Inc. To be promoted to the next level you have to demonstrate: a highly consistent level of job performance, display leadership skills, and have a team first attitude. On going education and training is necessary for survival in the biotech industry. Scientists learn new things everyday; to stay competitive you have to evolve your knowledge and processes.

What are the perks of Greg's job? Greg enjoys the consistent pace of his job and the flexibility. "Multi-tasking, busy paced continuous process really excites me in the work environment."

What was Greg like in high school? Greg did well in science, it was his favorite subject. Although looking back he now wishes that he would have taken more science classes in addition to biology and chemistry. Greg was given some advice in high school, "Attack each day full speed, 100%, all day." He remembers his drive in high school being supported by the belief that, "you only have the first 18 years of life to prepare you for the remaining 60 years and you only get one shot; find your passion and figure out a way to make a career out of it."

A Dream turned to reality Greg founded a non-profit organization to realize his dream of creating a safe, innovative haven for Bay Area youth. Greg wanted the youth to have somewhere to assemble, socialize and work toward their life goals. He created the non-profit so that youth in the bay area would have somewhere to play basketball and to take advantage of peer support. Greg spends all of his free time coaching youth basketball, which is his passion.

24 and on the way up Francisco Ramirez has not been "given" anything. This inspirational man grew up in Mexico, and moved to the U.S. when he was 18. He enrolled in community college in August of 2001- beginning in remedial and ESL classes, he is now a full time student at the California State University of Sacramento. Francisco is studying to be an Electrical Engineer, which requires a lot of math and science.

Background While Francisco attended high school in Mexico he struggled with math and science, especially physics. Francisco remembers in high school that there were times where his family and friend problems seemed more important than his school work. He wishes now that he would have dedicated more time to studying in high school. At the time Francisco did not realize how important it was to put continuous effort into his classes. While Francisco was at the community college he worked on his English writing skills, his spoken English was okay because he had spent summers in America at summer school. It took Francisco six years and some repeated classes to get to the university, but now he has the support of full scholarships through his involvement with MESA.

Something you wouldn't expect Not only has Francisco worked his way through college but he has also been responsible for providing for a family. Francisco is responsible for two kids and a wife while he follows his dreams of education and electronics. Francisco has been fascinated with electronics since he was a boy. When he was a kid he dissected his TV trying to understand how the components inside worked to turn the TV on. And as a young adult he enjoyed installing car stereos.

What math and science is important to him? In his major there is **A LOT** of math! Engineering geometry, different kinds of formulas for forces and direction, Algebra (all levels), Trigonometry, and Calculus- just to name a few. Francisco dedicates a lot of time to studying, these classes may be hard but doing well is not an option for him. His motivation is seeing results; this includes creating a better life for his family.

Internship in Chicago Francisco spent this past summer in Chicago. He was given plans that a senior electrical engineer had developed and then he would build the device. There were all kinds of different devices: some for monitoring other machines, gates that were programmed to do specific tasks, or building replacement pieces for the linear accelerator. The linear accelerator was the piece of equipment that Francisco and the senior electrical engineer were responsible for. Many times if something was wrong with it they would have to build a whole new piece to replace the malfunctioning one. When creating these devices math equations are used to program them. "Using Boolean algebra to simplify expressions, you can control the functions of each gate," explains Francisco.

Personal life…When Francisco has free time he spends it with his family. He also enjoys: the computer- internet and video games, listening to music, and hanging out with his friends.

Psychology and Computer Science Yesenia Jimenez is studying these two subjects at the California State University of Bakersfield. While she is going to school she also works for an organization called Transforming Local Communities, Inc. Both at school and in her work she uses a lot of math and science. For a 19 year old student she has a lot on her plate.

What keeps her motivated? "Knowing that I can always make a difference in the world is what keeps me going in life," says Yesenia. In the future she sees herself working with teens that are low income and first generation to America. She wants to be a roll model for those who are in need; she wants to be able to give them that extra push and motivation so they can accomplish their goals. Her overall motivation at the end of the day is, "I LOVE MAKING MY FAMILY PROUD OF ME."

What does her job entail?
Yesenia starts her projects by creating a survey and sending it to, either the school or agency that is being evaluated. When she gets the surveys back she has to count and code them. When that is finished, Yesenia enters the surveys information into the data base that she has created for this specific evaluation. Yesenia runs the data from the data base through SPSS. While the data is running through SPSS, she also runs FREQUENCIES on the data. Through these processes Yesenia obtains the data's percentages. She then prepares a report of the outcomes and gives it to the school or agency that was being evaluated. In her final step Yesenia writes a formal report or brochure that has all the data displayed in graphs and charts.

What makes her job exciting? "The wonderful research," she says. Being able to get so much information from numbers and the opportunities to make decisions based on percentages.

Natural learner in high school? "Math has always been my favorite subject ever since I began school in Elementary. I have always felt that when it comes down to learning math it comes more natural than learning biology, science, or chemistry. I dislike Science A LOT!" says Yesenia. "I do believe that my success in high school is what has gotten me where I am today, but I also believe that just because you had NO success in high school you would be in an unsuccessful position now, everyone is capable of success!"

Yesenia's personal time She is still young and can't afford to travel yet, but she is very excited about when she will have the opportunity. She loves: computers, dancing, watching movies while hanging out with her friends, rollerblading, soccer, and she especially LOVES running.

Becoming a Research Associate Therisa Truong is a 26 year old scientist. She graduated from the University of California Davis with a degree in Human Development. When she was finished there, she enrolled in a Biotechnology Program that is funded through a Workforce Investment Board. When she completed that training she was offered the position she is in today.

Looking Back… Therisa remembers her high school math and science classes as being really hard. She enjoyed her math and science courses, but also had to work very hard to earn good grades. She thinks now that if she had hired a tutor or formed a study group it would have made her high school experience easier. Therisa also remembers that in high school she did not have anyone encouraging her to succeed. All of her success is based on personal drive and commitment to studying. "It would have been nice to have a real person who went through hardships in school and is now successful to give me encouragement," Therisa says.

What does a Research Associate do? Therisa extracts RNA from blood samples, and she checks the quality and the quantity of the RNA in the blood. She uses calculations to do this; the calculations dilute the sample so she can extract this information. Therisa uses lab skills that she learned in high school, college, and from her biotechnology program.

Perks? "I get to work with a great bunch of intelligent and nice people." Therisa says. She enjoys being around scientists and doctors all day, they give her the drive to continue her education even further. Therisa adds, "I am getting paid for doing experiments that I enjoy doing!"

Her plan for lifelong learning "I am learning new things every day while I am at work." At Therisa's job scientists come in and give presentations of research projects they are working on and what they are finding. This happens often and gives Therisa an opportunity to keep learning more about the always changing science world. Therisa does not get bored because she is constantly given the opportunity to discover something new. "I am given a different project to do every couple weeks," Therisa says.

Influences outside of work Therisa's proudest and most life changing moment was when she graduated from college. So far nothing has topped that day for her! Whenever she gets the chance Therisa likes to travel, she also really enjoys going on cruises. Before she dies Therisa is planning on visiting every continent.

17 at UCLA? Ray Avalos is a 17 year old freshman at the University of California Los Angeles. He is studying Electrical engineering, something that he has enjoyed since he was small. Ray is lucky in that he has, as he puts it, “A natural drive to do well and get the job done.” But luck has nothing to do with where he is today. He worked really hard in high school at his math, science, English- pretty much every class- and did many hours of homework a night to get to the University ahead of schedule.

WIZ KID? NO Ray’s most influential experience happened to him early on, in elementary school. He was not the “smart” kid; he was just an average student. Ray was not given an intellectual gift, as he puts it. But through the support and encouragement of his parents and teachers he started putting in extra time, like doing outside part time reading. Ray watched his grades starting to improve, through his hard work Ray has gotten where he is today- at a UC, learning, working hard and having fun. “Anyone can accomplish anything; if you really want something you’ll do anything to get it.”

When he is not studying… Ray enjoys playing racquetball at the courts on campus. He also likes to: play baseball, play the guitar, and try to get friends together to hang out, grab something to eat, or watch movies.

Life at UCLA… For his electrical engineering degree Ray is studying all math and science. Calculus, computer programming using c + +, wide varieties of science: chemistry, physics, and quantum physics. All of his science courses are necessary because electricity has to do with atoms and certain elements are more beneficial for certain components. Computer programming is necessary because circuit boards (which control electronics) follow formulas for their commands. Ray is happy that he has already established good study habits, dedication, and motivation. These things help him stay focused to first do well and then gives him the opportunity to do the fun extracurricular activities.

Why he enjoys electrical engineering Ray’s dad works as a manufacturer of circuit boards, like the ones in cell phones. “When I was small I was able to visit my dad at work and I decided I wanted to pursue a career in circuitry too,” Ray explains. When Ray was younger he was fascinated that something so small could have so much power. Now he enjoys the complex systems, that electricity can send a text message or that you can call across the world from a cell phone. He really enjoys assembling things and watching them do what you have programmed them to do. Ray participated in the UCD “cosmos” program one summer where he was able to program Lego robots. Ray has also taken a course at the community college on computer programming.

Dennis Del Corro
Dennis is a Production Technician or Biotechnician in the Purification Department for Bayer Healthcare Pharmaceuticals. He uses math and science in his everyday work to produce a medication that many people depend on.

What he has learned since high school He has learned the importance of purpose and life. "I think as a high school student, I found myself asking, 'Why do we need to learn all this?' When I started working at Bayer and I was introduced to the product that we make, who uses our product, and why they need our product, there was a sense of purpose. It was suddenly clear to me that it was not just a job, but it was about saving a person's life. And that gave me that motivation, drive, and inspiration to do my daily tasks." He adds that if he could go back, he would try to absorb as many concepts in high school as he could, because later in life you understand why they are important.

He loves his job Dennis enjoys knowing that he has helped people everyday by producing the medication they need. Once or twice a year patients will come on site to meet them and he finds it really rewarding when they thank him for his work. Other perks are the company activities like picnics and outings. One year all the Bayer employees and their families were invited to the Santa Cruz Beach Boardwalk and everything: food, rides, parking, arcade games, music, and more were paid for by the company. The work atmosphere is another perk for Dennis, "People love what they are doing and when people love their job, the atmosphere is different. People are happy and friendly, and that makes you look forward to work everyday."

One day on the Job "My job at Bayer is in the Purification department where we purify the protein that becomes a final product that helps people with Hemophilia. When people with Hemophilia get wounded, they don't have the ability to clot blood and therefore they will just keep on bleeding. They don't have a factor in their blood that does the repairing when there's an open wound, and that missing factor is what we manufacture. In this department, we run equipment and make a lot of preparations. We make the solutions that we use and in making those solutions, it is critical that we have an accurate calculation. For example, we have to be 100% sure of how much acid we will pour in one solution. We have to perform tests for pH levels and conductivity. A simple mistake can cause the entire batch to be dumped and it costs millions of dollars. Not to mention, the patients that should have had the product."

What he does with his free time- Dennis takes his family out somewhere, he loves to spend time with his family on the weekends.

Saribel Daza is a 28 year old who works for Varian Medical Systems, Inc. in the reliability engineering department. She

started with the company right out of college, when she did an on campus interview with the company. She has a strong background in math and science through her Electrical Engineering degree from the University of Santa Clara. She uses basic math and science skills everyday when she is testing new equipment.

High School memories When Saribel was in high school she had a group of nutty friends who all took as many classes as they could squeeze in. By her junior year she had already taken Calculus I, so for her senior year she was taking Calculus II at San Jose State. Not only did she take more math than was required, but she also took more science. In science she took everything all the way up to Biology II. Saribel also remembers that she had a very supportive family; her parents were never pressuring her to get the A. They just wanted her to get a good understanding of the concepts, and if she really struggled with something they would say, 'you'll get it next time.' Looking back Saribel is very thankful for all of her advanced efforts. All the subjects she had studied in high school were less intimidating in high school; than seeing them for the first time in college. She remembers that she had to keep studying at each level until it started getting easier, but nothing came naturally to her.

On the job with Saribel Varian creates machines that deliver cancer radiation treatment. They have many technicians that create the machines and Saribel is the engineer who tests them. Because these machines deliver radiation treatment to cancer patients, they have to be very accurate every time and maintain a high standard of performance. While she has the machine, or parts of the machine, in her lab she simulates what it would do in the hospital and puts it on a cycle to look for weak spots or inconsistencies. She tests the machine or parts under pressure using: high temperatures, low temperatures, vibrations, and radiation. "Stress it out to make sure it holds up under all conditions," says Saribel. To simulate the machine or a parts function, Saribel has to write an equation for the circuit board to follow.

Variety is a plus Saribel enjoys her job because everyday she is testing something new. What she is working on or learning is never the same for months at a time, so it keeps her interest peaked. "With each thing I test I learn something new."

It pulled it all together for her When Saribel was a junior at the University of Santa Clara she took a Megatronics-Robotics class. She had been taking all the required math and science courses and was now in the upper division electrical engineering courses (also a lot of math and science) when she started thinking, 'What is the point?' But when she enrolled in this class she was able to use all of her math classes to put together programming equations and her science courses to determine good materials for building a robot. When she got to put it all together and see the robot do something, physically move around it brought her education together as well. She finally understood what the point was.

General Contractors Danny Morris comes form a long line of general contractors, going three generations back. Danny uses a lot of math and

science everyday on the job. He started his career by going to Northern Arizona University in Flagstaff and getting a bachelors in Construction Management. After graduation he worked for four different companies in management positions getting practical business application experience before he started his own general contracting business.

How he uses math and science Danny uses geometry for surveying a job initially, looking at the property layout and roof pitches, etc. Danny uses Algebraic equations and multiplication for estimating the costs of materials and approximate labor hours to give the client a bid on the job. Science-wise he uses physics for engineering structures and fastening systems and botany for identifying wood types and understanding the structural qualities of different types of wood.

How he continues to learn Danny subscribes to trade magazines: this Old House, Remodeling, Architecture today, and Construction Equipment, to name a few. "Technology changes so rapidly it's easy to be out of date. If you stay on top of new technology you can offer a better product to customers and for a better price."

Danny's passions in life are: music, guitars, and his bands.

Most influential experience His semester abroad in London while in college. The most important thing Danny learned is that you can exist without everything you are used to having. "Being in another place far away from your family, friends, possessions, and comforts you learn that you can do without those things and still be happy and productive. Learning to live without your possessions is valuable, not only for practical survival uses, but also because you appreciate everything so much more when you come home," Danny Explains.

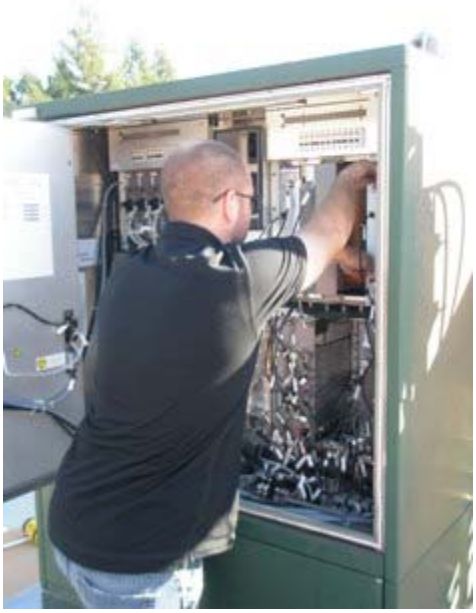
High School In high school he did well in science because he enjoyed it. Math he did not do well in because he did not enjoy it. He did not do well in math because he did not want to spend a lot of time on it, "now it turns out it's what I use more than any other skill set." "I wouldn't do it any differently, the things I did excel at turned out to be important for other things. Besides," Danny adds jokingly, "taking the same math class over six times gives you a really good understanding of it." Danny remembers that you can not be *told* anything in high school. His success or lack of was all on his own doing. "People pushing me only turned me off from things."

Advice for everyone Learn a musical instrument. It's like learning another language; he has personally gotten a lot out of playing an instrument. It is very mathematical with the reading of notes and intervals, but it is an all inclusive social appreciation. Music can bring people together like no other commonality. Playing music is fun and it is good exercise for your brain, it keeps the left side of your brain in tune.

Cell Phone Service Jerry Crabdree is a field technician for T-Mobile that means that he does wireless telecommunications maintenance. In order for cell phones to work they have to have reliable cell sites that house the radios, antennas and so much more equipment. Jerry learned the telecommunications trade in the military when he worked for the intelligence department. He uses a lot of math everyday in the engineering part of his job. He has to use formulas to figure out how much transmission power each site is putting out. Then he has to use more formulas to make sure that adjacent sites are matching up, giving full coverage throughout the area.

High school life When Jerry was in high school he worked really hard in his math and science classes, but he still only did okay in them. Looking back Jerry realizes that although he was working hard, he was not putting in enough time per day. Jerry remembers his 12th grade math teacher told him to, 'apply yourself in college.' Jerry went to college for one year at Central Missouri State, but then went into the military because he was unsure of the direction he was going and he wanted the federal college money. Jerry remembers his motivation in high school, "people wanted me to realize my potential." Jerry doesn't feel like he followed that motivation and now he wishes he had. "If you work and study harder in high school, you will do better in college."

Day-to-Day work at T-Mobile Adding a new sector to a site, this means that T-Mobile has decided to cover another direction from one particular site. In order to do this Jerry has to use a formula to figure out which direction and at what degree the new antenna has to be pointing. He also has to figure in what kind of terrain the new antenna will be covering and how it will affect the coverage of the new signal. Because Jerry's work is mostly outside some days he has to snowmobile to a site. On these days they may have to service a radio, which holds cell phone calls, or maybe the power has gone down and killed the area's service. Either way it is Jerry's job to make sure that all of the sites he is responsible for are working and maintaining cell phone service.



Life changing experience Jerry lived in Italy for 6 months working as a contractor for the military. Being surrounded by a different culture and language made him re-evaluate everything he was familiar with. He considered his way of doing things in America and compared them with the way he was doing things in Italy. Jerry learned to appreciate all cultures.

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