Latinos in STEM Professions: Understanding Challenges and Opportunities for Next Steps

A QUALITATIVE STUDY USING STAKEHOLDER INTERVIEWS

"... as you go up the stages of education, the number of Latinos falls off dramatically and is not indicative of our general population, so we have ... what I like to characterize as a leaking pipeline ... how could we fix that ..."

— A Latino STEM professional, January 2008

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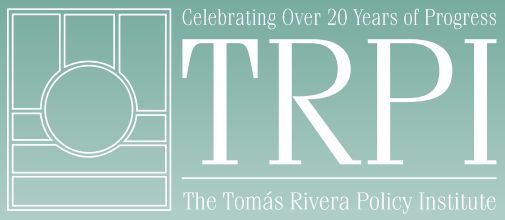

The Tomás Rivera Policy Institute (TRPI) advances informed policy on key issues affecting Latino communities through objective and timely research contributing to the betterment of the nation.

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The Center for Latino Educational Excellence (CLEE) was established as a major initiative of the Tomás Rivera Policy Institute in the spring of 2002 to help improve educational attainment and achievement in Latino communities across the United States. Through its policy research, CLEE seeks to provide guidance for Latino leadership — across public, non-profit, and private sectors — on how to better the current systems of education that are, on many levels, failing Latino youth and adults.

OBJECTIVES OF THE STUDY

Discrepancies in education outcomes between Latinos[1] and their non-Hispanic white counterparts have been previously observed and analyzed, yet the problem still persists. This study aims to give a voice to key stakeholders who can inform policymakers, programs and foundations on how to employ effective strategies to increase Latino participation in the professions of science, technology, engineering and mathematics (STEM).

The stakeholder interviews complement and confirm findings from the companion literature review report, *STEM Professions: Opportunities and Challenges for Latinos in Science, Technology, Engineering, and Mathematics*. The responses from these stakeholders reinforce the existence of the various barriers and challenges outlined in the report, as well as the solutions recommended to empower and prepare Latino students, including the importance of mentoring, teacher preparation, and parental support.

This is a qualitative study that seeks to understand the "why and the how" of Latino participation in STEM careers.

This TRPI study has the following specific objectives:

- To draw lessons learned from the challenges and opportunities faced by successful Latinos in STEM careers
- To gauge the future need for STEM professionals which should inform how best to prepare Latinos for careers in the STEM sectors
- To better prepare Latino students academically as well as motivate them to choose and complete STEM degrees
- To determine next steps and ensure collaboration among the major stakeholders

The results of the survey will clarify the challenges and opportunities in pursuing a STEM career path, using these insights to inform next steps and to identify areas for collaboration in order to increase Latino participation in STEM careers.

[1] For this report we use the terms Hispanic and Latino interchangeably in reference to persons tracing their ancestry to the Spanish-speaking regions of Latin America and the Caribbean.

METHODOLOGY

STUDY PARTICIPANTS AND DATA COLLECTION

During the period from December 2007 to February 2008, four groups of stakeholders were interviewed: educators, corporate employers (those who need and hire STEM professionals), Latino STEM professionals, and elected officials. Each interview lasted approximately 30-45 minutes. TRPI researchers used the convenience sampling method to identify about five representatives from each group to be targeted for interviews. Interviews were done in person and by phone.

Targeted questions were constructed to take advantage of the wide range of enlightened perspectives that each stakeholder group could offer regarding the issues under study. For example, Latino STEM professionals were asked how they achieved their career goals, the challenges and opportunities they confronted in choosing STEM careers, and what could be learned from their professional experience to improve Latino participation in STEM careers. Educators were queried for their suggestions about how Latino youth can be better prepared and motivated to choose STEM careers. Industry players were asked about the future need for STEM professionals, and for suggestions about how youth can be better prepared to meet that need. Lastly, all groups, including elected officials, were asked about the next steps to translate recommendations into action and generally move reforms forward.

ANALYSIS

This is a qualitative study to understand the challenges and opportunities faced by Latinos seeking to participate in STEM careers. Interviews were professionally transcribed. Responses to each question were coded for themes under each issue, until such responses began repeating and common responses emerged. This allowed investigators to easily identify key perceptions and opinions on the main issues related to Latinos and STEM careers. Responses were compiled for each subgroup.

FINDINGS

PATHWAYS, CHALLENGES AND OPPORTUNITIES FOR LATINOS IN STEM CAREERS

When asked if it is important to increase Latino participation in the STEM fields, a non-Latino STEM industry leader responded as follows:

> *"Absolutely critical. First of all, the technology industry is going to continue to grow, and all jobs, whether they're specifically in a company like ours or . . . in retail or whatever, are going to require more technology information and competence and skills, so it's absolutely critical as the Latino population in the U.S. grows, that a workforce [is] available for these jobs . . . we have to be sure that the population is prepared to participate. So it's important for the success of the technology industry and technology related jobs in the U.S . . . .It's especially critical in places like Texas that have a large population . . . that is the workforce of the future . . ."*

Industry leaders also stated that aside from academic achievement and high-level technical skills, they also look for soft skills. Interview performance and extra-curricular activities provide indicators of the job applicant's soft skills. In fact, these soft skills were mentioned as highly determinate in achieving success in the corporate ladder of STEM:

> *". . . the ability to lead, the ability to team with others, collaborate, the ability to communicate effectively verbally and in writing. All of those kinds of things are very important for success."*

Regardless of soft skills, it is necessary to possess technical competence to be successful in STEM careers. The Latino STEM professionals interviewed for this survey were generally self-confident and rated themselves as above-average to superior compared with their peers when they were in high school. The section below discusses their pathways in entering the STEM field.

SOURCES OF INSPIRATION AND MOTIVATION

The successful Latino STEM professionals interviewed for this study attributed their decisions to pursue a STEM career path to: having a Latino role model, learning from teachers and mentors who believed in them early on, and having supportive parents.

For one highly successful Latino engineer who is now an astronaut, his role model was the first Latino astronaut who traveled into space. He heard his role model interviewed on the radio and that sparked his interest to follow in his footsteps:

> *". . . the original inspiration came when I was approximately nine [or] ten years old and we were watching one of the last missions for Apollo on our TV and basically watching the astronauts on the surface of the moon. Just like any other nine or ten year old kid at that time, I had aspirations to become an astronaut and I think it was only solidified when I finally heard that the first Latino got selected, who was Dr. Franklin Chang-Diaz, who subsequently became my mentor. He got selected in 1980, right when I was a senior in high school. I knew I was college-bound and I knew I was going to go into the sciences because that's where my natural strengths were, but it was at that time that I basically made a promise to myself . . . 'OK, now that the barrier has been broken or a path has been laid before us, I'm going to do everything I can in my power, to get selected myself.'"*

The rest of the interviewees identified teachers and mentors who believed in them and guided them in making career choices which contributed to their successes.

> *"It was a physics and calculus teacher . . . My other sister did go down the engineering route initially, but we all ended up with the engineering route at the end of the day, so he was very, very instrumental in getting us excited about the math fields."*

But for all the interviewees, having supportive parents was the key underlying factor. It did not matter whether their parents were non-college educated and non-U.S. born. In fact, the parents of all Latino STEM professionals interviewed for this study had only elementary school educations, and were all non-U.S. born.

> *"My parents are uneducated, relatively uneducated, from Mexico . . . they understood that the key to this great big unknown that they were not a part of, and . . . understood that they might not ever be a part of fully, was something that they could provide to their daughters."*

BARRIERS FACED BY LATINOS IN STEM CAREERS

Latino STEM professionals, educators and industry leaders further underscore that Latinos generally undergo the following types of challenges which make their chosen career pathway difficult but not impossible to follow:

Latino Students Experience a General Difficulty in Adjusting to College Life and its Academic Demands

Latino students may experience some sort of culture shock as they move from high school to college, generally because of a larger, non-minority environment and a more demanding academic learning institution.

> *". . . regardless if it was STEM or not, I think the big challenge was . . . [coming] from a very small town, and a small town from South Texas, to a huge university at UT Austin where there's 50,000-60,000 people and now you're a minority, when in South Texas you're a majority to be Hispanic . . . now you're a minority and everybody is as smart or smarter than you."*

> *"Everything was different. In the classrooms, I'd always been the star pupil and suddenly I'm not. I'd always gotten a lot of attention without even asking for it, and suddenly it's not there, so literally every single thing about my freshman year was culture shock . . ."*

Latinos Sometimes Must Contend with Various Cultural Barriers Within Their Families

Non-Supportive Parents

Some Latinos who are capable of achieving academic success may be hindered by the fact that their parents are not supportive of their academic or professional advancement, due to general misconceptions about college education.

> *". . . parents may not have the education, or the network, or know of any role models that are in the STEM fields. That parent just needs to be very, very open to having the kid grow and kind of fly away, because I know a lot of parents, especially second generation, [who] come from Mexico, [who] don't allow their kids to grow and develop."*

Educators, industry leaders, and elected officials also observe the following within-family cultural barriers which may prevent certain students from successfully getting into STEM careers:

Parents May Have Gender-Based Expectations and Stereotypes

> *. . . sometimes we have situations, for example, where females are not allowed to leave home to go universities.*

> *Sometimes a female will miss school at our level because they're at home taking care of younger brothers and sisters . . . girls are supposed to be nurses and teachers and men are supposed to be engineers and scientists . . . I think this may go back to the students [who] are the first ones to go on to college . . .*

Parents May Be Biased Against Education Loans

> *. . . there's a concern that you don't borrow money, you don't take out an educational loan to go to college. You only go if you have a scholarship or you work to go, so sometimes we have kids who have to drop out because they have not been allowed to take out a loan or because they didn't get a scholarship . . .*

Parents May Misallocate Family Funds Into Non-Education Priorities

> *Sometimes parents are so proud that their kids are going to become high school graduates that . . . they buy them a car their senior year in high school instead of putting that money towards tuition for college . . . and so I don't know that all of those are necessarily unique to Hispanics, but some of them are.*

There May Be Family Pressure to Earn an Income Right Out of High School

> *There are some other pressures that might keep a student from completing a Bachelor's degree, maybe pressures about getting a job earlier than that, getting a job in high school or right out of high school as soon as they're able to work and some of those kind of things end up taking over and they don't complete their degree.*

Lack of Mentorship

One respondent mentioned that a lack of consistent professional mentorship throughout one's career is a problem:

> *. . . it is something I think a lot of us face . . . that we don't have any role models, we don't have enough people telling us the many options that we have, and so in my mind I was just going along, I didn't have enough people to talk to who could advise me about what my options were, and that was a major problem.*

Racial/Ethnic Discrimination

It was also mentioned by some interviewees that there may be instances of both blatant and subtle discrimination in applying to schools and jobs:

> *It's just typical stereotype challenges . . . it's the constant having to work very hard to achieve the respect of your peers and where you see other people don't have to work as hard [but] receive as much respect as you do or maybe even more, I think those were certainly challenges to me . . .*

> *. . . The professors are picking who they're going to be working with. They become the gatekeepers. A lot of times they hire people who look like themselves. It's not done on purpose, but it's just sort of happens . . . so even if you have a university policy, you still have those kind of issues . . .*

FACTORS DRIVING LATINO SUCCESS IN STEM CAREERS

Financial Support

Latino STEM professionals benefited from the general consensus among federal government, the state, universities, and communities that Latinos need financial support in pursuing university education. As a result, the Latino STEM professionals interviewed for this study were able to fund their college education by a combination of financial aid, scholarships, student loans, and work-study programs.

One interviewee opined that work-study opportunities may give the most flexibility and empowerment to Latino college students:

> *It [work-study] gives you more of a sense of earning the support. You know, just straight grants and loans go to the university . . . and you have less discretion on how to use that money. There's also a concern about being too much in debt, so even though students loans are for a worthy goal, getting your education . . . a lot of us are just very fearful [to] graduate from college having too much debt.*

Affirmative Action Based Opportunities

Affirmative Action based programs helped one interviewee overcome a stereotype threat, allowing him to "get his foot in the door," so to speak, of a top research laboratory in his field of study.

> *I'll give you a good example of where I think an Affirmative Action type of program helped me out quite a bit . . . I took it as a challenge because I said, "I'm going to show them so that my second co-op I could come in the traditional way," and sure enough, I worked my butt off during the first co-op. Come second co-op, I got hired in the traditional method, thus giving somebody else an opportunity through that program to come in. Subsequently I worked 15 years there in a very successful career. I don't like to see entitlement programs where it's a continuous entitlement, but I like to see programs where it gives someone like myself an opportunity . . . had that program not existed, I would guarantee you I would never have had my foot in the door at Lawrence Livermore Lab and I probably wouldn't have achieved my goal of becoming an astronaut.*

Support Network for Latinos Majoring in STEM

Minority outreach programs that target primary and secondary school students, such as the statewide Mathematics, Engineering, and Science Achievement (MESA) program, have been lauded by our interviewees as being highly effective. MESA has been acclaimed nationwide as one of a handful of programs that really works (*Science*, 13 November 1992, p. 1190). The program targets under-represented minority students who are already "doing well" in school and offers extra preparation to help them succeed in the competitive college atmosphere. Another program that was mentioned more than once by interviewees as being highly beneficial is the Society for Hispanic Engineers (SHPE), which assists Latino college students by providing a support system:

> *As I said, MESA played a big role and encouraged me to pursue engineering. In college, I was also involved in SHPE, the Society for Hispanic Professional Engineers, and I got a lot of mentorship there to talk me through everything from putting together a resume and applying [and] interviewing for engineering internships and that's kind of how I got my first job . . .*

> *. . . the Society for Hispanic Professional Engineers . . . organizations like that help students have a support network to help you get through the tough times, the tough tests or tough class or professor and who [to] take and don't take and when to take this class versus that class. Those types of networking and support groups are very, very important, because you can also have study groups inside your classes, but sometimes you're more comfortable if someone's Latino . . .*

WAYS TO PREPARE AND MOTIVATE LATINO STUDENTS TO ENTER STEM FIELDS

Educators and Latino STEM professionals stated that the STEM pipeline for Latinos is broken in terms of acquiring the necessary academic training to both get into a STEM major in college and, more importantly, to actually graduate with a STEM degree.

Years of hands-on experience have provided valuable insights to educators on how they can better prepare and motivate Latino youth to choose STEM careers. Our respondents include two high school principals, a district board member, a program director and a superintendent of a small college.

Educators discussed the unique challenges and opportunities associated with preparing Latino students in K-12 education for STEM careers. To better prepare and motivate Latino students toward STEM careers, educators cite the following strategies:

Start Early: K-12 Curriculum and Teacher Quality Must Be Improved

> *They can best succeed in college when they have been well prepared in high school by a rigorous college preparatory program specializing in math and science. They are motivated to choose a tough high school program when they are allowed to succeed in middle school, and also when their elementary schooling exposes them to the fun of math and science. Most elementary school teachers find this to be their weakest area, so THAT needs to be addressed at the university level where teachers are trained.*

> *. . . one of the biggest reasons that students . . . drop out and is because they're . . . inadequately prepared to go to school and to study in these fields, and part of the problem is, and especially from a lot of the public school system, is not only what the students are learning, but how they're being taught . . .*

Teachers Must Have High Expectations for Their Students

> *That's basically where we don't allow students to fail, failure is not an option. I think that ties in very heavily with expectations.*

The "Disconnect" Between Courses in High School versus Those in College Needs to Be Addressed

> *. . . one of the biggest reasons why kids fail in college is . . . they don't even have the skills that they need. They may have taken algebra, they may have taken even calculus and gotten an A in their class, but what their classes look like in high school is a lot different than what they're expecting in college.*

Educators state that students need to be supported as they transition from high school to college. Bridge programs such as the MESA and the Puente Project provide support for college-bound students such as counseling and tutoring:

> *. . . we need to have teachers from the community college meeting with the high school teachers to make sure that they transition, that the curriculum helps students transition from the high school to the college level and [that] they're already prepared for college-level math. Right now that's not happening . . .*

> *I think there are great opportunities because you have programs like the Puente Project and MESA . . . and there is a university with a science and engineering program and they work with school districts. So they came in . . . and the Puente Project is . . . good too because that gives you a bridge to college, but those kinds of programs are really effective in getting kids to go to universities and getting kids to study science and engineering.*

Mentorship for Students is Very Beneficial

> *I really think finding . . . even in the university, finding mentorship [by] an upper level student or a graduate student or even a professor to help mentor students, that's been very helpful.*

Students Need to Be Exposed to STEM Careers

Exposure programs are those that provide role models, competitions, and work-site tours.

> *. . . we sponsor a . . . competition for high school kids to build a robot.*

> *. . . one of the things that has been done here is we have a program called HESTEC . . .*

> *. . . a unique feature of Med-COR is that it is a collaboration between the Los Angeles Unified School District and USC and more specifically between LAUSD and the Keck School of Medicine because that's where we are located, within that school, which means that we have access to med students, we have access to faculty, we have access to research labs for certain experiences for them. We have access to the hospital. So the students can gain hands-on experiences that allow them to see exactly how their STEM interests relate to the occupations . . .*

Schools Need to Solicit Parental Involvement and Support

> *One of the things that we do is bring parents in before their students even start and we tell them basically what our program looks like and the benefits of coming to our school and the expectations that we'll have of students and their parents so that they know what they're getting into before they start, and then when they get here, if we need the support of parents, we call on them and we basically talk to them about being a team with us . . .*

Parents need to be aware that developing proper study habits in high school is important in preparing students to take on college work loads:

> *. . . actually students who are well-organized and well-trained, who are prepared psychologically and behaviorally for STEM research will do okay in college, but those who are not, the ones that we're talking about now in high school, will carry that habit into college and they'll have troubles. So we've got to habituate them in ways that allow them to manage their time, to make choices, and so on, so that they are able to complete the tasks that are assigned to them.*

Educators can also help address cultural barriers within the family by communicating with parents about the importance of education:

> *"The piece that we could probably improve on, is working with parents, trying to overcome some of the cultural barriers. For example, we've even had some of our professional staff meet with parents individually and talk to them [saying], 'Give your daughter a chance to go,' We've had take it on a one-to-one level. So I don't think that we're making a whole lot of progress in that area because we're trying to overcome generations of culture, but I think it's better than it was when I first came here."*

CURRENT OPPORTUNITIES FOR LATINOS IN STEM

Educators also discussed current opportunities in place to encourage Latinos in STEM:

STEM-Focused High Schools Targeting Latinos Can Be Very Effective

Exceedingly well-run schools located in cities that are densely populated by Latinos do well in attracting students to, and training them in STEM.

> *"In the Dallas ISD, there are a couple of opportunities in place to encourage any student interested in a path in STEM. Science/Engineering Magnet High School has greatly improved their program over the past 12 years and is now internationally recognized for their efforts in this area. Another local high school, Conrad, has just this year begun to implement a STEM Academy inside a pre-existing high school. There are plans for others in the future. These programs encourage all students regardless of ethnicity; however, Dallas will be over 67% Latino within a couple of years, so more Latino students will naturally be involved. When I ran SEM, I considered it one of my main responsibilities to actively recruit minorities to come and be involved. Eighth grade students often need a great deal of encouragement to leave friends at their old school and come into a separate, challenging program."*

> *"The program I developed at Science/Engineering Magnet High School at the Townview Magnet Center is extremely effective. For example, we were rated by Newsweek as the number two school in our nation—this rating relies heavily on the number of Advanced Placement exams taken. For the last several years, College Board has consistently ranked us #1 in the nation for AP Calculus exams passed by Latino students. Recently, Time Magazine named us the 18th-best school in the nation overall . . ."*

These STEM-focused high schools create an environment in which students feel encouraged to be smart and to work hard, minimizing peer pressure from others to do poorly:

> *"Another reason SEM is so successful, is that we were able to create an environment where being smart was okay! It became a point of honor to do your best, to win contests, and to achieve. That environment draws the students who are interested in these careers and ensures they will get the most out of demanding classes."*

Various Programs Promoting STEM Are Also Effective Since Students See Tangible Results in Terms of Being Exposed to STEM Careers and Role Models

> *"There's [MESA] . . . and there's the mentorship program that we have, Northrop Grumman. There's also a program called First Robotics . . . you have a corporate sponsor and then they work with the students and it's a six-week program where they design a robot for a competition then they compete against each other."*

> *They are very effective because what happens is that it gives the students tangible results . . . part of the problem is that kids don't see a relationship between what they're studying in school and what the opportunities are going to be for them once they're done with school . . .*

> *It's called MARC now, Minority Access to Research Careers now and it's through the NIH. Those kinds of programs make a huge difference. They provide the experiential learning that . . . we don't have otherwise. It provides an instant access to mentors, to like-minded people, to options and alternatives that we may not have considered. It's just that it's very expensive too.*

Tutoring Programs in Math

> *. . . our library has been really good about offering programs, so they have tutoring programs in conjunction with APU . . . They first started tutoring in English and reading and now they offer tutoring in math.*

Active Recruitment by Colleges and Universities for Under-Represented Minorities

> *One of the things that's been really successful for us . . . one of our flagship universities, Texas A&M . . . has a recruiter who actually comes in and works at the school and we've seen our applications to those universities rise probably close to 1000% just in the last year or two, and that's just because someone has come in . . . they even go to the homes and talk to parents and they hand-carry applications. It's not just a big impersonal process.*

NEXT STEPS AND AREAS FOR COLLABORATION

Latino STEM professionals, STEM industry leaders, educators and elected officials were asked to offer suggestions for next steps and areas for collaboration. The following points are the cumulative results of their responses.

IMPORTANT INTERVENTIONS TO BE IMPLEMENTED FIRST

- Develop stronger academic preparation for K-12 students to get them ready for STEM courses in college. This can be done by improving teacher quality, curriculum quality, and offering tutoring and mentoring services to students.
- Create bridge programs that address gaps between high school and college, and between 2-year community colleges and 4-year colleges or universities.
- Make students aware of opportunities in STEM and promote STEM among Latinos. This can be done by introducing students to role models—such as Latino STEM professionals, getting them mentored by role models if possible, and exposing them to STEM careers through field trips and internships.
- Schools and parents need to communicate more frequently to address issues such as the child's study habits, within-family cultural barriers which may hinder academic opportunities for the child, and availability of financial assistance for Latinos in college.

RESPONSIBILITY FOR IMPLEMENTING THESE INTERVENTIONS

The stakeholders are well aware that everyone has a shared responsibility in implementing measures to increase Latino participation in STEM. The different sectors can help carry out this shared responsibility in various ways such as providing funding, implementing programs, or merely making learning science and math fun.

> *"... the implementation requires a diverse partnership with shared responsibility. Unless all the stakeholders do their share, we will not achieve our goal of an additional 100,000 engineers by the year 2012."*

The Federal Government

> *"Going back to the College Cost Reduction Act, which was signed by the president, now already in law, includes a landmark $200 million investment in Hispanic-serving institutions, which I will refer to HSI, with the priority of producing more STEM graduates and for developing pathways to the STEM fields . . . They're very proud of those accomplishments because that is part of a broad federal investment in higher education that is equivalent to the GI bill of 1944. You'll see that over the next five to ten years, a big increase in students [going] into those career paths."*

The School District

> *"At the district level . . . you decide what the priorities are of the district, but . . . you're really deciding curriculum, you're deciding who's getting hired to teach, so . . . it comes down to schooling, a lot of the major decisions on how things are going to happen, even down to teacher-student interactions, is being decided at school district levels."*

The Schools

> *Right now students are coming in and they're not prepared . . . schools need to have in place those supports . . . where there's extra tutoring, one-on-one tutoring, and other extra classes. One really effective thing that they have at a lot of schools now is if you're going to go into science and engineering, the schools have a summer program just for minorities.*

> *National Association of Secondary School Principals does really well . . . They have identified schools that are doing the kinds of things that we all should be doing and then they of course have a big . . . program and they conduct interviews and they have them at national conferences and they publish your e-mail addresses and stuff like that so you get e-mails from other schools wanting to duplicate yours or, "How did you do this?" or, "What did you do when this happened?" that kind of thing. I really think that's the way to do it. It's slower, but I don't think we're effective doing mass scale.*

The Private Sector

> *. . . The private company that has some type of interest in pursuing the research of this widget . . . they agree to pay the student some type of salary so he can work on his research related to the widget that the company is interested in. "I'll solve the company's problem at a reduced rate." The university gives the research grant, everybody's happy, and then when he or she graduates, then hopefully the company has hired the student working on that widget.*

FINAL THOUGHTS

Create a National Dialogue Among Stakeholders

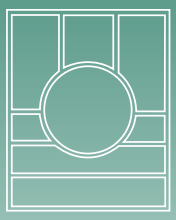
> *. . . we need to have a national dialogue and we need to have everybody part of it, and that means not just . . . your K-12, your universities, your academics who usually get involved in these discussions, but also the corporate world where they need to say, "This is what we want and you're not giving it to us," and I think that might be the leverage . . .*

Just Do It

> *Go out and do it. Start with what we've got and make it better. Talk to teachers, principals, school boards. Take regular school and make the programs better. Take good programs and make them great. One class is better than none. An entire school is better than a section. One child headed in the right direction is better than none. Don't look to someone else to do it . . . you do it.*

Promote STEM Professions

> *What's wrong with doing PR . . . you know, with doing PR, putting commercials on television to sell being a scientist in the way that you can sell a car, you know?*



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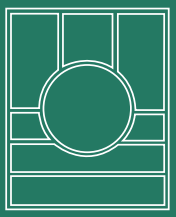

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