



America's Competitiveness

Hispanic Participation in Technology Careers

SUMMIT REPORT

Increasing Latino Participation in Science, Technology,
Engineering, and Mathematics (STEM) Careers



September 2008



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TABLE OF CONTENTS

- EXECUTIVE SUMMARY 1
- INTRODUCTION..... 4
- THE PICTURE TODAY 6
 - Innovation Cannot Wait: Creating Future STEM Professionals 6
 - Leaky Pipelines or Rocky Pathways: Tough Obstacles for Latinos Entering STEM..... 7
- SUMMIT OUTCOMES: DEVELOPING NEW STRATEGIES TO INCREASE LATINOS IN STEM..... 8
 - STEM-Centered Education Reform..... 8
 - Teacher Recruitment and Retention 9
 - Providing Financial Incentives for Math and Science Teachers..... 9
 - Pedagogical and Curriculum Change..... 10
- INFORMING AND SUPPORTING STUDENTS AND FAMILIES 12
 - Helping Students Bridge the Curriculum Gap..... 13
 - Easing Latino Students’ Financial Concerns 13
 - Parental Involvement 14
 - Marketing and Media Strategies to Promote STEM Among Latino Families..... 15
- COORDINATING NONPROFITS AND NGOS..... 17
- THE BUSINESS SECTOR AS CATALYST AND INFLUENCER 18
- CONCLUSION 19
- RESOURCES 20

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The contents of this report are based on the presentations and discussions from the 2008 IBM Corporation inaugural summit titled *America's Competitiveness: Hispanic Participation in Technology Careers*, which was held May 5th-6th at the IBM Executive Conference Center in Palisades, New York. We would like to acknowledge all speakers, sponsors, and attendees who participated in the event for their valuable contributions to this subject matter. In addition, we extend a special note of recognition to Nicholas Donofrio, Executive Vice President of Innovation and Technology, IBM Corporation, who served as the conference keynote speaker and facilitator.

We would also like to thank The Tomás Rivera Policy Institute for their contributions to this report and to Glenda M. Flores, TRPI Fellow, who served as rapporteur of the summit. We also thank Katja Stromnes-Elias and Wendy Chavira for their insightful comments.



September 2008

Dear Friends:

IBM stands committed to help address the critical shortage of job candidates in Science, Technology, Engineering and Mathematics (STEM) and, in particular, the low participation by the Hispanic community in those fields of study. As you have undoubtedly heard me say before, our failure to address those trends has the potential to affect the future of America's economy.

When IBM—along with co-sponsors ExxonMobil, Lockheed Martin and Univision—set out to hold the inaugural summit titled *America's Competitiveness: Hispanic Participation in Technology Careers*, we were motivated to develop an action plan that would lead to increasing the number of Hispanic students pursuing careers in science, technology, engineering and math in the United States. With the help of nearly 150 leaders in business, education, government, and community organizations, we did just that.

IBM will continue doing what we do best—dedicate our best technology and talent to help address the issues. We have already started moving forward on our commitments from the summit. We are expanding our grant programs—such as Reading Companion, KidSmart Early Learning, ¡TradúceloAhora! and accessibilityWorks—in school districts and nonprofit organizations serving the Hispanic community; and we are growing the number of Cascade Mentoring programs which enable professional IBM mentors, university students and K-12 students to engage in a three-way mentoring relationship using our MentorPlace program. But IBM cannot do it alone.

As you read this report summarizing the discussions and recommendations from the summit held May 5-6, 2008, we hope it will encourage you to take action and do your part to ensure that America remains competitive and that we continue to support the Hispanic participation in STEM careers.

Sincerely,

A handwritten signature in black ink, reading "Nicholas M. Donofrio". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

Nicholas M. Donofrio
Executive Vice President, Innovation & Technology



EXECUTIVE SUMMARY

Employment opportunities in science, technology, engineering, and mathematics (STEM) are expected to increase at three times the rate of other fields in the next decade. Yet Hispanics—who will make up almost one-third of the U.S. population by 2042—are not well-positioned to take advantage of this key industry. Stimulating Latino interest in STEM careers, developing strategies to improve STEM education, and finding ways to effectively involve all stakeholders—students, parents, educators, policymakers, and the corporate and philanthropic sectors—is crucial for the development of the Hispanic community, and also for the future of our nation. Seventy million baby boomers will be exiting the U.S. workforce in the next two decades. To keep up with the increasing demands of a service- and knowledge-based economy and a competitive global marketplace, it is imperative to recruit and train more STEM professionals.

In May 2008, IBM and co-sponsors convened the summit “America’s Competitiveness: Hispanic Participation in Technology Careers.” The summit brought together leaders from business, education, government, and community organizations to develop an action plan to increase the number of Hispanic students pursuing and entering careers in STEM fields in the United States.



Nicholas M. Donofrio, IBM

Following is a synopsis of the strategic plans that emerged from presentations and small group meetings at the conference. Recommendations were made in the four main sectors spotlighted at the summit: education, students and families, non-profits/non-governmental organizations, and corporations. Media emerged as an important area of focus during the conference. The full report that follows includes a more in-depth analysis of the issues and barriers encountered by Latino youth, as well as more detailed discussion of each sector and recommendations developed by conference participants and the IBM Corporation.

The summit itself was an example of the collaborative methods required to increase the number of Latino STEM professionals. All stakeholders present—educators, parents, community organization leaders, elected officials, corporate leaders and media members—have key roles to play in developing coordinated, effective projects to address the issue.

1. EDUCATION

The entire educational system—from early childhood to postbaccalaureate studies—needs reform to ensure that Latino students are aware of STEM fields, are able to enter them and can succeed. Latino students lag behind their non-Hispanic white counterparts in terms of educational achievement at all levels. Just over half of U.S. Latinos are high school graduates. College enrollment drops to one in three Latinos. Reducing the attrition rate of Latino students in STEM majors in college is of primary concern. Recruiting and retaining high-quality math and science teachers, to counteract their scarcity in U.S. schools, is also key. Curriculum and pedagogical practices need to address the state-of-the-art in STEM fields and schools need to make math and science priority subjects.

ACTION PLAN

(with the understanding that many of these are under school district and state control)

- **Develop targeted financial incentives for math and science teachers, including providing extra resources for professional development in these subject areas.**
- **Revise curriculum and rethink pedagogy to ensure math and science are taught at the highest levels in kindergarten through 12th grade.**
- **Create a formal credential and certification process for STEM schools and programs.**
- **Devise a program to ensure that students who enter college to study STEM majors receive support including mentors and other resources in order to complete their education.**

2. STUDENTS/FAMILIES

Latino students and their families frequently do not have the financial means to provide the added funding for school success. Many also face a language barrier with school personnel, experience cultural conflicts with their children, and/or have not have attended U.S. schools. They lack information about STEM careers and how best to help their children enter and succeed in those fields. Still, most Latino parents value education and hold high aspirations for their children. Students often lack adequate preparation for college-level work in STEM-related disciplines, and need extensive support to gain access to preparation such as AP classes, and tutoring and mentoring that can help them stay in STEM-related majors.

ACTION PLAN

(many of these items focused on ideas that would support parents and students—all of which could be taken on by all stakeholders—educators, community organization leaders, elected officials, corporate leaders and media members)

- **Provide information to families—in Spanish—so they understand STEM as well as the benefits and financial compensation for STEM professionals.**
- **Partner with Latin American schools to establish programs for students to study abroad.**
- **Form partnerships with the media to represent Latinos in STEM-related fields in television series and documentaries to help inform students and families.**
- **Create public service announcements to persuade students and families of the need for Latino STEM professionals.**
- **Increase the popularity of STEM careers in the Hispanic community through marketing campaigns and innovative Web 2.0 efforts illustrating STEM careers.**

3. NON-PROFITS/NGOS

Non-governmental organizations and non-profits operate various programs to help Latinos in the educational realm, yet they need to communicate better and build interdependent relationships.

ACTION PLAN

- **NGOs and non-profits must collaborate and consolidate their efforts to avoid working at cross-purposes on projects that might not necessarily help the ultimate goal.**
- **Establish accountability measures for all organizations to ensure proper use of funds and suitable progress.**

4. CORPORATE/PRIVATE SECTOR

It was generally agreed at the summit that effective initiatives require corporate/private sector leadership to fund projects to increase Latino participation in STEM fields. This should be accomplished by cultivating new ideas directed at piquing Latino interest in STEM careers through the media, finding viable means to change the curriculum and pedagogy, increasing the presence of qualified math and science teachers, seeking adequate parental involvement, and partnering at the nonprofit and non-governmental levels. The corporate/private sector should also form partnerships with educators, non-profits, and the media to determine how they themselves can successfully support such programs financially.

ACTION PLAN

- **Find ways to provide financial incentives to teachers, students, and parents, and develop loan-forgiveness programs for qualified science and math teachers.**
- **Implement more Transition to Teaching programs to encourage retiring baby boomers to become teachers.**
- **Fund community-based programs at the local level, including informational seminars—in Spanish and English—aimed at convincing parents and students from underprivileged communities about the benefits and feasibility of STEM careers.**
- **Engage in a national campaign that draws attention to the scarcity of STEM professionals and highlights the potential loss of our competitive edge.**
- **Provide technical literacy education to teachers, parents, and students through educational institutions and community organizations at the city, district, and county levels.**
- **Partner with the media to showcase Latinos in STEM-related fields in a variety of media and marketing formats including television series, public service advertisements, commercials and documentaries.**

In summary, IBM's pursuit of increasing Latino involvement in STEM careers will help keep America at the apex of the curve of intellect and also grow our great nation as a global leader in critical STEM fields. The overall success of these initiatives will depend on people from each of these four areas—education, students and families, non-profits/non-governmental organizations, and corporations—taking an active role and doing their part. Everyone needs to focus on the end goals: to encourage Latino students to pursue STEM, to recruit and retain qualified math and science teachers, and to bring parents into the overall process. Non-profits, businesses, and the media will be successful by sharing and participating in the same big-picture vision.

INTRODUCTION

The lack of Latino¹ representation in STEM (science, technology, engineering, mathematics) careers is an urgent problem which threatens the economic well-being of the United States. Nicholas Donofrio, Executive Vice President,



Pete Martinez, The Quantum Group, Inc.

Innovation & Technology at IBM Corporation, describes the situation as one ruled by the “tyranny of the large and small numbers.” The “large” number is the growing Hispanic population, which already comprises the largest ethnic group in the country. The “small” number refers to the severely reduced participation of Hispanics in STEM careers. Creating more Latino STEM professionals is not just a matter of equal representation. Given demographic trends, it is also essential to maintaining America’s competitive edge in the global market.

In light of these pressing issues, IBM and cosponsors convened a summit, *America’s Competitiveness: Hispanic Participation in Technology Careers*, on May 5-6, 2008, bringing together 150 leaders from business, education, government, and community organizations to increase Latino participation in STEM careers. This report synthesizes presentations and group discussions from the conference. It also discusses stated and implied challenges, as well as action plans for stakeholders—education leaders, nonprofits, non-governmental organizations and businesses—to develop a coordinated effort to prepare the next generation of Latino STEM professionals. All quotations in the report are taken from statements made by participants in the conference.

In an impassioned opening speech, Donofrio discussed the importance of STEM to our country’s future:

“[STEM] is the future of our country and somehow we don’t seem to be taking ... the issues that I perceive seriously. The first issue is that we don’t appreciate the STEM disciplines enough in this country. We don’t worry enough about them; we are not thinking enough about them; we are not being concerned enough about them. The real wealth generation, that’s what’s going to hold this country in good stead, and how well we prepare the now generation for the future is going to determine our success.”

Conference participants concluded that education leaders, businesses, and community organizations working to attract and increase Latino participation in STEM must strive for impact and improvement in four areas:

- The educational curriculum
- Alignment between all non-governmental organizations
- Financial incentives for science and math teachers
- Family participation

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.

Developing a media strategy around each of these areas was also deemed an important element in the success of the effort. By bringing together stakeholders from the various areas in which people and organizations are tackling this issue, and focusing on approaches that can adapt to changes in technology, this effort overcomes the silo effect that can often doom plans to failure.

Economic, demographic and educational trends are converging to create a dire situation. As the share of service- and knowledge-based jobs within the U.S. and global economies increases dramatically, the need to recruit and train more students in STEM disciplines becomes more critical to sustaining our country's technological and economic edge. The U.S. Department of Labor Statistics expects jobs in STEM fields to grow 22% between 2004 and 2014. This will require close to two million new STEM professionals to enter the field in the U.S. by 2010 to replace retiring baby boomers alone. Over the next two decades, 70 million baby boomers are expected to exit the U.S. workforce. Among them, 2% of Latino scientists, technologists, engineers, and mathematicians will retire. Currently, about 5% of the general U.S. population works in STEM-related jobs, but only 2% of U.S. Latinos work in those occupations (Mc Gee, 2008).

Latinos are the fastest growing population in the United States. In 2004, they numbered 40.4 million, comprising 14% of the total U.S. population (NACME, 2008). By 2042, they are expected to grow to 30% of the U.S. population (U.S. Census, 2008). Already, Latino children comprise more than half of the school-aged population (Gutierrez, 2004).

Latino students face numerous barriers to entering STEM fields. Studies indicate that Latino students continue to drop out of high school at an alarming rate, graduate in small numbers, and are rarely exposed to curricula that would spark interest in STEM professions (Chapa and De La Rosa, 2006; TRPI Report, 2008). Latino students who do go on to two- and four-year institutions are often ill prepared for the college curriculum and the challenge of STEM-related courses (Tornatzky, et al., 2006; TRPI Report, 2008). In 2001, Latino students attending U.S. educational institutions earned 7.2% of all bachelor's degrees and 4.7% of all master's degrees in math and science. Doctorates numbered only in the hundreds (Chapa and De La Rosa, 2006).

Educators, community organizers, and business groups with experience tackling the problem have discovered that Latino students are generally not encouraged by teachers to pursue careers in STEM, that Latinos rarely have Latino mentors who are science or math teachers, that Latinos experience cultural gender role conflicts, that Latinos are not exposed to curriculum related to these careers, and, more often than not, that Latinos do not have the financial means to attain higher education (Gandara, 2006; TRPI Report, 2008).

Some important projects have attempted to address the scarcity of Latinos in STEM. For example, IBM recently focused its MentorPlace program on engaging more IBM employees to be online mentors to Latino students in U.S. cities with high Hispanic populations. But much more is needed. Previous attempts and strategies to increase Latino participation in STEM fields have failed, in part because educational institutions and business and community leaders attempted to create their own solutions rather than working together with participants from each group focusing on what they do best. Adalio Sanchez, General Manager, Modular Systems, IBM Corporation outlined the most effective role for the business sector:

"IBM and other companies in the private sector can be effective in planning, managing, and operating a variety of programs that use company resources, people, technologies, contributions, and the time and talent of their companies to support the improvement and effectiveness of all efforts to improve the STEM-preparation programs. They can also be effective reaching out to their clients, business partners, and others to create common ground and shared strategies, and can leverage these activities to obtain more effective response from the public and voluntary sector from K-12 and higher education, too."

THE PICTURE TODAY

INNOVATION DOES NOT WAIT: CREATING FUTURE STEM PROFESSIONALS

“ In a world that has been transformed by technology, in which the boundaries of mankind have been erased in the pursuit of human capital so that a radiologist report read by your local doctor may have been created in Pakistan, and if you have a problem with a credit card, as I recently did with some charge that wasn't mine, I ended up with a call center in South Africa. In the pursuit of human capital, in the delivery of service, and the production of a product, we are globally challenged. In order for the nation to be the global economic leader, it needs to be at the apex of the curve of intellect. ”

— Honorable Robert Menéndez, Senator, New Jersey



Honorable Robert Menendez, Senator, New Jersey; Nicholas M. Donofrio, IBM (left to right)

The traditional skills learned in school that prepared workers for industrial-era jobs—reading, 'riting and 'rithmetic—fall woefully short of what is now needed to navigate a knowledge-based economy. Technical literacy, knowing how to navigate internet-based resources and having an “engineering-system type of thinking,” is essential, according to Dr. Irving Wladawsky-Berger Chairman Emeritus, IBM Academy of Technology.

To be at the “apex of the curve of intellect,” as Honorable Robert Menéndez stated, it is important to sustain the culture of creativity which has for many years made the U.S. a leader in technological innovation. To accomplish this, it is crucial for 21st Century STEM professionals to master both traditional and technical literacy. To compete with the rapid development of STEM industries in other parts of the world, it is essential that the U.S. mobilize more of its population to enter STEM careers. Given that Latinos are comprising an increasing portion of the U.S. population, it is crucial for Latino youth to be well-educated and trained so they can prepare to enter

these fields. This will make an enormous difference on an individual level, and will significantly improve their communities and our nation.

The so-called “Space Race,” ushered in by scientific and military competition with the former U.S.S.R., moved technology and science to a central place in U.S. culture. The current situation calls for a similar cultural shift. In many other countries, STEM is a national priority and a great source of pride. In the home countries of many Latino immigrants, for instance, engineering and science are held in high esteem by everyone. As one conference participant, Pete Martinez, Senior Vice President, Chief Technology & Innovations Officer at The Quantum Group, Inc., stated:

“ To be an engineer in any Latin American country is one of the highest prestige professions you can have, right on par with a doctor ... There is a level of understanding in the families about what it means to be an engineer. There is a level of social status, of prestige; a challenge and a financial outcome that is expected of it. We have lost that in the United States; we don't brand engineering. As a matter of fact, engineering is typically associated with a sanitation engineer or somebody that drives a train. We have not taken it up and we focus too much on STEM as being science and technology versus what the outcomes of the profession would be, which are stem cell, technology innovation, energy and medicine. We [have] to focus a whole lot more on what the end game is versus the tackling and blocking that we are going to have to go through. ”

Creating a culture in the United States in which STEM is seen as a tremendous accomplishment and a valuable profession is necessary in order to begin to address what could potentially turn into a national crisis. We need to adequately deal with this issue or our country will rely more heavily on outside resources rather than our own untapped talent.

LEAKY PIPELINES OR ROCKY PATHWAYS: TOUGH OBSTACLES FOR LATINOS ENTERING STEM

We can characterize the obstacles Latinos face on route to STEM careers as forming either “leaky pipelines” or “rocky pathways,” as Shirley Malcom, Director of Education and Human Resources Programs at the American Association for the Advancement of Science stated. Either way, the difficulties are many and are well documented.

Research has identified many important factors that contribute to having so few Latinos in STEM fields: difficulty in adjusting to college life, culture shock, cultural barriers, gender-based expectations in families, bias against education loans, family pressure to earn income right out of high school, lack of consistent mentorship, and blatant and subtle racial/ethnic discrimination in school and the workplace (TRPI Report, 2008; Public Agenda 2008). Public Agenda stated in its 2008 report “Out Before the Game Begins” that, across the board, STEM professionals feel that the U.S. educational system is not serving Latinos well, and that this failure extends to all subject areas. The number one problem they identified is that because Latinos tend to live in impoverished communities, they primarily attend struggling schools with inadequate funding. Getting more Latinos involved with STEM fields is not just a matter of instituting specific programs; it will have to involve systemic solutions.

Latino students lag behind their non-Hispanic white counterparts in terms of educational achievement at all levels. Just over half of U.S. Latinos are high school graduates. College enrollment drops to one in three Latinos.

Educational obstacles to entering STEM careers begin early. An estimated 70 percent of U.S. middle school students receive math and science instruction from teachers who never majored in math or science and are not certified to teach the subject. For Latino students specifically, this means that they seldom see Latino role models in their schools to show them that it is possible to obtain and enjoy a career in a STEM-related field.

In recent years, national educational policy has de-emphasized STEM disciplines in favor of traditional literacies—the three Rs. Advanced math and science have taken a back seat to the English proficiency and basic math proficiency needed to pass high-stakes tests (Jorgenson and Vanosdall, 2002). Clearly, students must master basics in English and math. However, near-exclusive focus on these skills displaces important math and science concepts and skills that need to be learned early on. Our current educational accountability structure focuses resources on getting students to meet minimum performance benchmarks, to the detriment of preparing them for college. Eric Smith, Commissioner of the Florida Department of Education said, “For America to be excited and enthusiastic about math, physics, biology, is a culture change of monumental proportions. There is ... a low expectation in this nation that is going to require an accountability program that is second to none.”



Michele Lezama, GEM Consortium; Carolyn Vallas, NAMEPA (left to right)

When it comes to engineering, the situation is even more dire. It is estimated that 1.75 million engineers will be needed by 2010,² but if current trends continue, few new engineers will be Latino. According to the National Action Council for Minorities in Engineering (NACME), in 2005 engineering degrees accounted for 5.5 percent of bachelor's degrees awarded to Latinos in 1995, but only 4.2 percent of degrees awarded in 2005. The same report found that while Latinos were more likely than non-Hispanic whites to earn degrees in the social sciences and management, they were less likely than their white peers to have earned degrees in the natural and physical sciences. The statistics were equally as grim for Latinos earning engineering degrees at the master's and doctoral levels, and the numbers of faculty and employees in the engineering workforce.

SUMMIT OUTCOMES: DEVELOPING NEW STRATEGIES TO INCREASE LATINOS IN STEM

Participants at the America's Competitiveness summit were divided into discussion groups covering four stakeholder sectors—education, students and families, non-profit and business—to explore various strategies for increasing Latino participation in STEM. Highlights of the discussion, as well as recommendations, challenges and next actions for each of the four areas are outlined below. During the summit, participants underlined the importance of integrating media strategies into each of these areas, so a media component has been added to each section as appropriate.

STEM-CENTERED EDUCATION REFORM: RECRUITMENT, RETENTION & PEDAGOGY

“ [S]imply wiring schools and wiring classrooms and putting computers in the classrooms does nothing if we don't change the teachers, if we don't change the pedagogy, if we don't change the curriculum. We have proved that to ourselves for the last thirty years. ”

—Nicholas Donofrio, Executive Vice President, Innovation & Technology, IBM Corporation



Elane Scott, Birth2Work

The “add computers and stir” formula has not worked to substantially improve schools. Even more than hardware, improving schools requires improving pedagogical and human software. Even the smoothest pipeline to get Latino students into STEM will not work if teachers do not receive the support they need to be effective. We need a second pipeline to build a corps of high quality math and science teachers. All students need people in front of the classroom who can stimulate their thinking and encourage them to succeed; people who have studied and know the subject matter they are teaching. But because Latino students tend to attend schools with fewer resources, they are less likely to have well-trained, certified math and science teachers. Innovation breeds innovation, and teachers must be given the room to innovate their pedagogical methods. Math and science curricula must be up-to-date and partake of the creative spirit that advances science and technology.

2 “Facts for Features: Hispanic Heritage Month 2007,” U.S. Census. (Available for download at http://www.census.gov/PressRelease/www/releases/archives/facts_for_features_special_editions/010327.html)

Conference participants concluded that the priorities for tackling the daunting task of educational reform needed to address the following areas:

- Teacher recruitment and retention
- Curricular and pedagogical reform
- Shifting legislated accountability systems to focus more sharply on skills necessary for success in studying STEM fields in college.

Teacher Recruitment and Retention

In their issue brief, the Business-Higher Education Forum indicated that the “United States faces a critical shortage of highly qualified math and science teachers that will require an additional 283,000 teachers in secondary school institutions by 2015” (BHEF, 2006). In addition, many teachers currently teaching at the middle and high school levels do not understand the engineering profession or the broad spectrum of STEM-related industries and are therefore not able to give that message to parents and children. Math and science teachers need to be educated in these matters.

According to conference participants, training highly effective math and science teachers requires attention to undergraduate programs, where students are first exposed to a teaching track. Encouraging students trained in science and math to become teachers will ensure that they will be comfortable with their charge.

Successful recruitment strategies discussed by participants included engaging school superintendents in the hiring process and providing incentive pay for master’s degree teachers in STEM content areas. Richard Mills, Commissioner of the New York State Department of Education, indicated that the Buffalo School District in New York, in an effort

to recruit math and science teachers, worked with college presidents so that superintendents would be informed of who was in the teacher pipeline. This allowed these teachers to get first priority in student-teaching slots. In this case, schools and colleges worked together and recruited early.

One idea from the work session on education to jump-start the number of qualified Latino math and science teachers was to implement a visa program to recruit qualified immigrant Latin American math and science teachers. Other ideas included implementing programs to encourage math and science professionals and retirees to transition to teaching, modeling after IBM’s Transition to Teaching program.

Providing Financial Incentives for Math and Science Teachers

“It should be obvious to everyone that you cannot fill shortages in math and science if the scarcest field is compensated exactly as everyone else. We have to break that.”

—Richard Stephens, Senior Vice President, Human Resources and Administration, The Boeing Company



Myrna Peralta, National Hispanic Education Alliance



Lorraine Cortes-Vazquez, New York State Department of State

There are various methods to give math and science teachers financial incentives and support in order to draw more qualified people into the field. One is differentiated pay, in which a higher pay scale is implemented for fully credentialed teachers licensed to teach math and science courses. However, the terms of differentiated pay need not be static. For instance, a form of differentiated pay in New York City focuses on financial and housing packages for teachers who teach in neighborhoods where they are needed.

School districts rarely provide differentiated pay. Yet it may be possible for the private sector to invest in those incentive payments and make them available to students as well as to schools that show improved or high results on the Advanced Placement (AP) exams in math and science. In Florida, for example, the state has implemented a program for teachers to receive financial compensation when students do well in AP courses. Teachers and schools receive advanced payment for performance of a 3 or above on an AP exam.

Tom Luce, Chief Executive Officer of the National Math and Science Initiative (NMSI), explained that an NMSI program offers incentives to teachers who complete the NMSI professional development course to become advanced placement teachers. The organization then gives teachers who have passed the development course an additional bonus for every student who scores a three or above on the AP exam. Some teachers have earned an extra \$10,000-20,000 during the school year through this program.

On the financial aid side, loan forgiveness geared specifically to credentialed math and science teachers can be implemented. Loan forgiveness is already in place in several other high-demand careers such as medicine.

Pedagogical and Curriculum Change

“ I am not interested in engineers, scientists, mathematicians, and technologists by rote. As a businessperson, I am interested in people who can solve problems and create real value, innovation. ”

—Nicholas Donofrio, Executive Vice President of Innovation and Technology, IBM Corporation

True innovation in STEM curricula and pedagogy requires many changes in order to make teaching more effective. This includes creating curricula and teaching strategies that are more culturally relevant for Latino students (González, Moll, and Amanti, 2005). It also means creating relevant and adequate math and science instruction and materials.

While countries such as China, Korea, and India have poured ample resources into graduating a vast corps of engineers that far outstrips the U.S., their educational systems remain rigid, producing engineers who have mastered the past but have difficulties with creative problem-solving.

Mainstream American education is conducted in English, but the Spanish language is a crucial and innovative learning strategy for Latino students so that nothing is lost in translation. In the new knowledge economy, it would be beneficial to train and teach people in their first language because people do their best work in their language of origin. Scholars have pointed out that students learn best when taught in their native tongue, which ultimately leads to learning English faster (Hakuta, 1993).

In high school and higher educational institutions, the model of teaching is rooted in the 1960s and tends to weed out students who start to fall behind rather than finding ways to help them succeed. Students still tend to be “tracked” into courses of study that lock them into a certain level of instruction across the board, even if their skills in different areas vary widely. In Texas, all high school students are given the chance to enroll in AP courses regardless of their academic background, limiting the weeding out of students up front.

Conference participants recommended that instead of requiring students to complete four years of physical education, such as in New York State, that at least one year focuses on STEM-related fields—and that students who fall behind be given additional support.

To create alignment in the curriculum, it was suggested that college professors and high school teachers should hold meetings in which they discuss what is covered in their classrooms and what is expected of students.

Additionally, schools need to strengthen math and science courses to give students the fundamental skills and body of knowledge required to meet industry-wide standards. The idea of developing a STEM certification or some form of accreditation for schools and programs came up in several of the discussions at the summit. Participants also suggested adding internship opportunities to coursework to create well-rounded STEM programs, and to encourage high academic standards in these subjects.



Jeff Okowski, Liberty Science Center

In addition, to entice Latino students and enhance their learning experience, part of the educational experience can promote internationalization and global diversity. Sending minority college students overseas to developing countries in their freshman and sophomore years would offer them an unmatched experience in their field of choice early on in their academic career. Students also would be inspired to bring back ideas to benefit the classroom and generate thoughtful discussion among peers and faculty.

Recommendations:

- Encouraging states to legislate adequate accountability programs for all elementary, middle, and high schools to focus on college preparation and skills critical to STEM fields.
- Developing programs that encourage students in science and math to enter K-12 teaching, including educational loan forgiveness programs.
- Partnering with schools in Latin America (the technical school in Monterrey, Mexico, for example) in order for students to study abroad, or for teachers and professors from Latin America to come here on special visas to teach courses in the United States.
- Creating and fostering innovative and culturally relevant teaching techniques and materials, particularly in schools with large Latino populations.
- Creating innovative curricula based on strengthened national standards.
- Having K-12 school systems and local colleges and universities cooperate to encourage and place math and science students in K-12 teaching jobs.

- Creating a type of Superfund³ funded by private and public sectors to give teachers significant financial incentives.
- Creating a formal credentialing and certification process for STEM schools and programs.

Challenges:

- The No Child Left Behind (NCLB) federal education and accountability requirements have had a serious impact on the allocation of resources and programming in public schools. In many cases, the focus on basic skills proficiency for NCLB has deferred attention and funding for STEM programs. States and municipalities with shrinking budgets leave public schools and colleges with tough choices for distributing resources.
- Political environment varies widely from state to state, affecting the likelihood of instituting initiatives such as differential teacher pay for math and science teachers.

INFORMING AND SUPPORTING STUDENTS AND FAMILIES

In general, many Latino students and their families have no concept of the rich diversity of jobs available in STEM fields. Parents may have vague notions about the existence of scientific or engineering work, but most have no clear idea about how they can help students prepare and succeed in the field. It is important to help parents and teachers understand the possibilities because they have daily contact with the children.

Students who have graduated from high school with inadequate preparation for advanced study are unlikely to survive higher education, much less enter STEM fields. But with adequate support, students can overcome the gaps in their skills and succeed.



Shirley Malcom, AAAS

Gender issues require special, culturally sensitive attention among Latino families. Latinas in particular are scarcely represented in STEM fields, even though they are entering higher educational institutions at far greater rates than Latino males. In many high schools and colleges, the presence of Latino males is decreasing (López, 2003). Shirley Malcom, Director of Education and Human Resources Programs at the American Association for the Advancement of Science, attested to the gender gap. She said that women are scant in engineering or computer science and that in many high schools “the guys are gone.”

Latino families are eager to have the next generation advance and succeed. But parents often lack the tools to properly support students. Information is crucial in order for Latino families to make decisions that will help students enter and succeed in STEM fields. But there are some key financial concerns that need to be addressed if the number of Latinos in STEM careers is to significantly increase.

3 A Superfund was born of legislation from the 1970s that taxed corporations to help clean up hazardous waste sites.

HELPING STUDENTS BRIDGE THE CURRICULUM GAP

High school and college curriculum can be a challenge for Latino students poorly prepared in their classrooms. Students may require programs such as summer school classes helping order to make the transition to more advanced study. Overall, schools need to provide support structures to address the varying preparation levels of Latino students making the transition to higher educational institutions. These support structures would expose them to the academic caliber expected of them, as well as the culture of collegiate life.

“Bridge” programs can help repair some of the damage caused by inadequate early preparation. For example, Summer Bridge Programs, the Educational Opportunity Program (EOP) or the Collegiate Science and Technology Entry Program (CSTEP) often begin before students start their first year of college. Early intervention programs such as these offer a needs-assessment phase in which students are given placement exams to assess their critical math and science skills. Programming addresses individual needs, and students can complete additional courses before starting school, improving their ability to stay and advance in higher education.

EASING LATINO STUDENTS' FINANCIAL CONCERNS

Financial aid programs such as the Federal Pell Grant and Perkins Loans are no longer as available or bountiful as in the past (Advisory Committee on Student Financial Assistance, 2001). Many Latinos relied on financial aid opportunities such as these to attend prestigious colleges and universities. The GI Bill still provides financial aid, but only to those in the military, and at lesser rates than in the past. In light of financial aid programs dwindling, other sources of financial aid must be sought for Latino students, especially sources linked to STEM fields.

Studies have shown that Latino families, especially immigrant families, do not use banks the way non-Hispanic whites do. They tend to be wary of taking out loans to fund their child's education. It is imperative to help persuade Latino families that it is fine to borrow money to pay for their children's education, by explaining the long- and short-term consequences of borrowing money. Therefore, community outreach—in English and Spanish—focused on parents is a way to ensure that Latinos access financial assistance available to all students.



Adalio Sanchez, IBM

Summit participants mentioned the America Competes Act as a way to increase financial aid to Latino students. In 2007, President George W. Bush passed the American Competitiveness Initiative to maintain a well-developed and skilled workforce in STEM. While the act contains provisions geared towards increasing the number of minorities and women who enter science and technology professions, writers of the act also are working to increase the funding by an additional \$30 million from the National Science Foundation, particularly for Hispanic-serving institutions.

These provisions will help expand opportunities in the science, math and engineering fields, particularly to underserved populations. Specifically, the legislation directs the U.S. Department of Energy to increase the number of women and minorities in science and technology fields at all education levels, from kindergarten to graduate school. It also establishes a new outreach program for underrepresented minorities in grades K-12 to encourage careers in science and technology.

AMERICAN COMPETITIVENESS INITIATIVE GOALS:⁴

- 300 grants for schools to implement research-based math curricula and interventions
- 10,000 more scientists, students, post-doctoral fellows, and technicians provided opportunities to contribute to the innovation enterprise
- 100,000 highly qualified math and science teachers by 2015
- 700,000 advanced placement tests passed by low-income students
- 800,000 workers getting the skills they need for the jobs of the 21st century

Targeted scholarships also are necessary in order for Latinos to increase their opportunities in STEM careers. While many scholarships already exist for minority students, they are often explicitly tied to career paths or do not provide the appropriate level of support for those interested in STEM fields. Scholarships for tuition and other expenses tied to schooling must be targeted to those interested in STEM.

One more way that students can be encouraged to focus on STEM fields is to offer financial rewards to those who complete AP classes and pass the AP exam. Additionally, the corporate sector can provide financial resources to offer internships and jobs to students.

PARENTAL INVOLVEMENT

Studies have shown parental involvement is key to Latino student success, despite Latino parents often not having a higher education (Tomás Rivera Policy Institute, 2008; Public Agenda, 2008). Yet immigration, poverty, and cultural differences can conspire to negatively affect Latino families. These social demands can impinge on Latino parents, “to the extent that it is almost difficult to tell them that they should be more engaged in their child’s education; especially given Latino cultural tendencies to have teachers deal with teaching and parents deal with raising their children,” explained Mirna Peralta, Executive Director of the National Hispanic Educational Alliance.

Some factors, while not exclusive to Hispanics, are more likely to affect Hispanic families. Fear of deportation for undocumented Latino parents often disengages them from school. Poverty also affects opportunities to enter higher education institutions. For many parents, language barriers prevent them from accessing services available to parents, forcing children to serve as interlocutors for them. If the students lack information about these services or do not understand them, parents who do not speak or understand English cannot advocate for them effectively.

In short, parents need to be engaged in the process of K-12 and higher education; they should be informed about STEM and how it can lead to success for their children. Conference participants suggested a multi-business fund that would create incentives for parents who engage their children in these careers. This would help parents learn about STEM and encourage their children to continue and complete their career journeys.

Parental involvement can make a critical difference in student success in math and science. For example, Dolores Fernández, President of Hostos Community College, attributed the success of the middle-school program housed at her community college to parental involvement and teacher encouragement. Hostos Community College is located in the poorest congressional district in the United States and is part of the City University of New York. She outlined the great strides she took to develop and offer adequate math and science classes. She also experienced success with Proyecto Access, a program in which middle school students are encouraged to attend a STEM Summer Program for six weeks. She said nearly all parents were on board with the initiative, and that students need to be told they can succeed.

4 American Competitiveness Initiative. Retrieval at <http://www.whitehouse.gov/stateoftheunion/2006/aci/>

“ Parental involvement is crucial ... The parents had to make a commitment. They knew what the program was about when they signed up their kids for this middle school. And they knew that if the kids weren't going to make it and if the parents weren't going to be there to support them then the kids were going to be moved out of the program. So high expectations and putting in place the program really shows kids that they can do it and that there is a future for them in math and science: that's all you have to do. ”

Other conference presenters added that the No Child Left Behind (NCLB) legislation has a parental component, but one of the real challenges has been how to activate it. For instance, Title 5 of NCLB promotes informed parental choice and innovative programs.⁵ Such standards in NCLB should be revisited for implementation.

MARKETING AND MEDIA STRATEGIES TO PROMOTE STEM AMONG LATINO FAMILIES

“ Creating a culture of interest and inspiration and excitement about math and science is absolutely essential, and the media does have to be brought in. ”

—Dr. Blandina Cardenas, President of the University at Texas at Pan-Am

Conference participants suggested establishing a national STEM day, week, or month, in which professionals would visit schools with anecdotes and other information that also could be publicized in the media. According to Dr. Cardenas, the University of Texas at Pan-Am has had success by creating a week-long conference related to STEM which attracts hundreds of students, use celebrities as spokespeople and has good media coverage and sponsorship.

Nontraditional methods can also prove effective to encourage Latino youth to enter STEM careers. As Pete Martinez, Senior Vice President, Chief Technology & Innovations Officer at The Quantum Group, Inc., said: “It cannot be the heroic model of going out and talking to the class of eighth graders. It can't be that way; the kids don't learn that way today. The youth of today are exposed to blogging, MySpace, and YouTube.” Such contemporary venues can be used effectively to reach students.

Conference participants expressed concern that, unlike in the era of mechanical technology, when hobbyists could easily take apart machinery to learn about it, the guts of the various technologies used in everyday life are hidden from students, making the gadgets they use daily mysterious and inaccessible. As Elane Scott, executive director of Birth2Work.org, said, “Most of those kids, what they know of technology they saw at Disneyland. They saw it at places where all of the technology creation was hidden from them.” Latino parents are purchasing video games for their children, but this does not necessarily mean that Latino parents or their children are connecting video games with a possible STEM career. In fact, video games could be a starting point for students to learn about STEM careers.



Ray Mellado, HENAAC; Keith Moo-Young, California State University; Anna Park, HENAAC; Robert Amezcua, IBM; Dan Arvizu, U.S. Department of Energy NREL (left to right)

5 No Child Left Behind. Retrieved at http://www.edsource.org/edu_nclb.cfm#features



Letycia Pastrana, Latin American Association; Sheila Jones, University System of Georgia (left to right)

Dr. Irving Wladawsky-Berger, Chairman Emeritus, IBM Academy of Technology, explained how students from difficult areas in the Bronx in New York were brought to a summit and shown video games. Provided with software from the Wii, the Xbox 360, and the PS3, the professionals explained to students what goes behind creating these games. Dr. Wladawsky-Berger said: “There was nothing more captivating for those kids than what was behind that curtain.”

Television series, documentaries, sitcoms, and cartoons were also suggested as venues for providing STEM role models and sparking interest in the field. Diana Gomez, National President of the Society of Hispanic Professional Engineers, and who was the presenter for the non-profit work group, indicated that members of their group suggested persuading Nickelodeon to make Jimmy Neutron, “like a Little Latino Jimmy Neutron.” Adalio Sanchez, General Manager, Modular Systems, IBM Corporation explained how documentaries have the power to appeal to students as far as the competitive edge and cool factor in STEM careers.

Recommendations:

- Giving families access to information about the possibilities of STEM career through fairs, materials in Spanish, media messages about STEM careers.
- Developing and duplicating after-school and summer programs that help students improve their math and science skills to enter and complete STEM-related degrees.
- Reduce undergraduate attrition rates for Hispanics in STEM majors through programs that provide intensive support for incoming Latino students (such as mentoring, guidance, and tutoring); student loan forgiveness for STEM fields when the student achieves their degree in five years.
- Relieving financial burdens through supplemental grants and scholarships for students who complete AP classes, enter STEM fields in their studies and their careers.
- Using video games and Web 2.0 tools—blogs, video-sharing and social networking sites—as a way to promote study and careers in STEM fields.

Challenges:

- Current financial aid for students in higher education is shrinking, so students are discouraged from entering lengthy, costly degree paths.
- Severe financial need will continue to pressure some families to ask students to contribute to the family finances immediately.
- Overcoming cultural biases related to gender takes time, and must be constant to account for newly arrived immigrant families with traditional views

COORDINATING NONPROFITS AND NGOS

Many nonprofit and non-governmental organizations (NGOs) already work to increase Latino participation in STEM fields. At this summit, there were approximately 27 nonprofits represented. However, as Diana Gomez, National President of the Society of Hispanic Professional Engineers, and the presenter for this group, stated: "Half of the nonprofits [here] didn't know what the other ones did." The nonprofit workgroup revealed a need to look internally at all of the programs and determine which organizations are doing well in their areas and focus on those so each organization is doing what it does best, not spreading itself too thin.

According to one conference presenter, information sharing is necessary on the part of all non-profits since many work on the same issue but do not share their results. The discussion group decided that each nonprofit or nongovernmental organization should focus where they can show relative success and then scale those accomplishments across the board. Better accountability measures also were suggested to ensure that all nonprofits were following through on their projects.

However, alignment and coming to a consensus might not benefit the ultimate cause, according to Nicholas Donofrio, IBM's Executive Vice President of Innovation and Technology. Rather, what is necessary is collaboration and consolidation. Donofrio suggested that partnerships are not the solution, but that all nonprofits and NGOs should become completely "integrated, totally interlocked, and totally interdependent on each other" to ensure everyone is on the same page.



Larry Calderon,
Nova Southeastern University

Recommendations:

- Non-profits and NGOs working to increasing Latino participation in STEM fields should caucus and coordinate efforts to maximize impact and minimize competition for funding.
- Information sharing benefits all organizations working in the field, yet it does not happen on a routine basis.

Challenges:

- Competition for funds and turf battles sometimes discourage organizations from cooperating.
- Non-profit organizations whose resources are stretched thin may be reluctant to set aside additional time and resources to coordinate with others.

THE BUSINESS SECTOR AS CATALYST AND INFLUENCER



Irving Wladawsky-Berger, IBM Academy of Technology, moderates the corporate leaders panel

According to conference participants, the most effective role for business and industry leaders interested in helping increase Latino participation in STEM fields is to leverage their connections and influence. The business sector must also supplement shrinking resources in the public and non-profit sectors.

Business and industry leaders, who have the best, most up-to-date view of what is needed today and in the future, can contribute needed insights into curricular and pedagogical changes. They can also cultivate new programs directed at piquing Latino interest in STEM careers via both “old” and “new” media. They

are also needed to implement programs such as those outlined above to increase the number of qualified math and science teachers, and can effectively support efforts to increase parental involvement.

As our society’s new heroes, business and industry leaders are also in a uniquely influential position to help change the public’s views about STEM, and to bring about the cultural shift necessary to maintain our country’s lead on technological and scientific innovation. They can help highlight a sense of national urgency about STEM in general, and Latino participation in these fields in particular.

Recommendations:

- Fund financial incentives for teachers, students, and parents who are interested in pursuing and invested in the STEM discipline.
- Engage in a national campaign that draws attention to the scarcity of STEM professionals and highlights the potential loss of our competitive edge.
- Provide technical literacy education to teachers, parents, and students through educational institutions and community organizations at the city, district, or county levels.
- Partner with the media to showcase Latinos in STEM-related fields in a variety of media and marketing formats including television series, public service advertisements, commercials and documentaries.
- Implement more Transition to Teaching programs to encourage retiring baby boomers to become teachers.

Challenges:

- Coordinating stakeholders will be difficult and take time.

CONCLUSION

The unachieved potential of Latino students in the STEM fields is significant and is crucial to harness for the future well-being of the United States. To realize this potential will require the support and commitment of the corporate community as well as nonprofits, non-governmental organizations, and educational institutions. IBM's concerns and leadership in this field ought to be acknowledged and endorsed. Most importantly, we all must work together to create a culture in which STEM is given priority. We must alert the nation that America's competitiveness is in danger if the attrition of STEM professionals continues unabated.



Participants at the summit

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