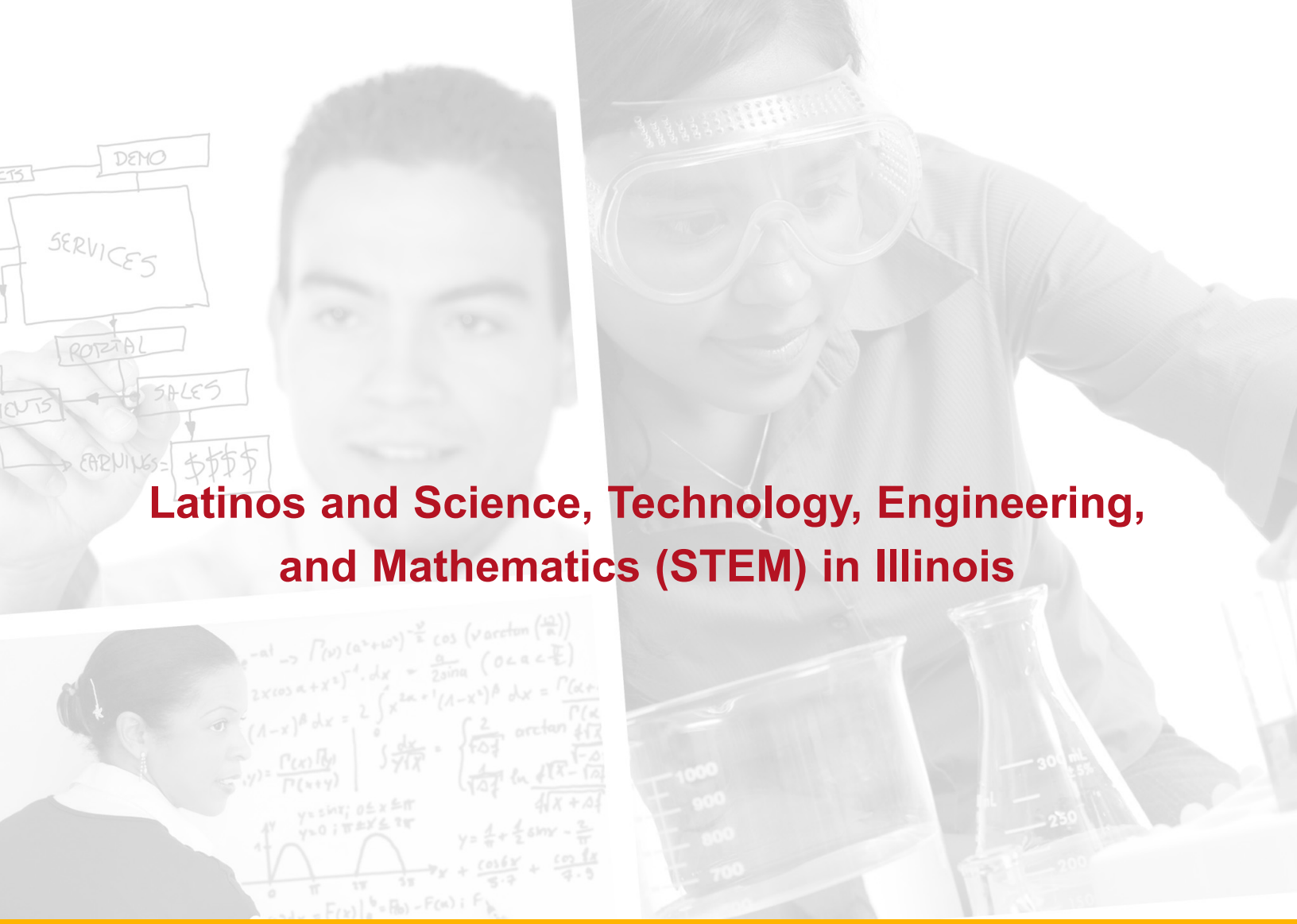

Latinos and Science, Technology, Engineering, and Mathematics (STEM) in Illinois

Created by the Institute for Work and the Economy and the Institute for Latino Studies at the University of Notre Dame for the Latino Technology Alliance

Latino Technology Alliance

Creating Opportunity. Building Prosperity.

Acknowledgments

This research project is the results of a nine-month collaboration between the Latino Technology Alliance* (LTA), the Institute for Work & the Economy (IWE), the Institute for Latino Studies at the University of Notre Dame (ILS), and the Illinois Department of Commerce and Economic Opportunity. The project was directed by Peter Creticos, President/Executive Director of IWE, and co-directed by John Koval, Director of Research at ILS. The core project team members at ILS include (in alphabetical order) Andrew Deliyannides, Senior Editor, Roger Knight, Senior Research Analyst, and Waldo Mikels-Carrasco, Research Analyst. Allert Brown-Gort, Associate Director, and Juan Carlos Guzman, Post-Doctoral Scholar - Center for the Study of Indiana Latinos, provided commentary throughout the project. David Weisberger, Director of Strategy and Development at the Latino Technology Association, and the LTA Board of Directors provided great oversight throughout the project by offering constructive suggestions and posing challenging questions at every step.

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* Latino Technology Alliance formerly known as Latino Technology Association

Latinos and Science, Technology, Engineering, and Mathematics (STEM) in Illinois

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Executive Summary

As the nation and the state navigate through the greatest economic crisis in decades, traditional economic development strategies are giving way to those that emphasize scientific discovery, technological innovation, and the ability to translate existing know-how into new products and services. Nationally, President Obama has set this as one of his top economic priorities. Illinois, too, has independently come to the same conclusion as evidenced by new efforts in scientific and engineering research at the state's major universities, the Illinois Critical Skills Shortages Initiative, and the recent sectoral-based work of the Information Technology Task Force of the Illinois Workforce Investment Board. The bottom line is that Illinois needs more scientists, engineers, mathematicians, technologists, and skilled technicians who can drive development in high technology.

Although today's economy is marked by frequent job changes among highly talented workers, many successful businesses cultivate a core group of home-grown talent to carry them forward. States and municipalities also recognize that their economic futures rely on their ability to attract newcomers while developing and retaining their own people who are essential in forming the social and cultural fabric that is the basis for living communities.

Illinois needs more scientists, engineers, mathematicians, technologists, and skilled technicians who can drive development in high technology.

Latinos comprise an ever-growing proportion of Illinois' diverse demographic make-up. Between 2000 and 2006 the number of Latinos has grown by nearly 24 percent to constitute nearly 15 percent of the state's population. At the same time, Latinos are significantly under-engaged in critical science, technology, engineering, and mathematics (STEM) fields. Despite comprising 13.6 percent of the total Illinois workforce (827,105 out of a total workforce of 6,087,756 workers), Latinos comprise only 4.9 percent of workers engaged in STEM (29,453 out of the STEM workforce of 604,150 workers). Overall, 9.9 percent of the Illinois workforce is employed in STEM occupations, but only 3.6 percent of working Latinos are employed in STEM.

Latinos will remain stranded outside the mainstream as long as the cycle of poverty, poor educational performance, and limited employment opportunities that characterize many Latino communities in Illinois are permitted to continue. By their sheer numbers, Latino youth's persistently low test scores in STEM subjects and their very low participation rates in college-level STEM are hampering our state's ability to compete.

But the loss to Illinois is not only about squandered talent. Latinos in STEM occupations give Illinois a competitive edge in new global markets where bilingual communication and cultural competence are key advantages. If Latinos remain under-represented in STEM, Illinois will not be able to keep up, much less continue to lead, in industries that will serve as the backbone of the new economy.

This report breaks new ground by synthesizing national and state-focused research on Latino employment and education performance with new analyses of Illinois data and with findings from a series of community conversations across northern and central Illinois. These conversations included Latino high school and college-age youth, Latino technology entrepreneurs, human resources managers who make STEM hiring decisions, secondary and post-secondary STEM educators, and career guidance counselors. While this report offers many insights, it also reveals where our knowledge is limited, especially as it applies to Illinois.

Key Findings

• In 2007 Latinos age 18 or over comprised 13.2 percent of the US population but were employed in only 5.5 percent of information technology jobs nationally and only 5.8 percent of key non-IT high technology jobs.

• In 2000 and 2007 Latinos in Illinois comprised a lower share of IT workers than the national share (4.1 percent and 4.8 percent respectively). They also did less well in non-IT high technology employment than the nation as a whole in 2000 (4.1 percent), but grew at a faster than average rate by 2007 to a 7.9 percent share.

• Latinos in science and engineering (S & E) earn lower median salaries than all S & E workers, $60,000 for Latinos in 2003 compared to $66,000 for all S & E workers.

• Latinos are at an educational disadvantage in pursuing careers in STEM occupations as evidenced by low scores in standardized tests in mathematics and literacy.

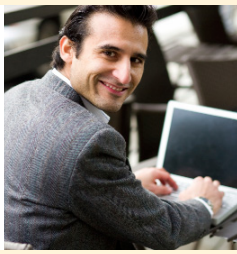
• Educational intervention programs have been shown to be critical factors in increasing Latinos' entry into the STEM pipeline.

• Effective early childhood education programs and interventions in secondary school that provide access to a rigorous curriculum help widen the mouth of the STEM pipeline.

• Schools that serve minority students in areas of concentrated poverty have less access to computers, have limited access to the internet, are less likely to use computers for complex forms of learning, and have teachers who less frequently use computers for instructional purposes.

• Knowledge about how to advance to college is low among Latino parents. Knowledge deficits were significantly greater among parents with lower income and educational backgrounds as well as among first-generation immigrants.

Despite representing nearly 15% of Illinois' population, Latinos comprise only 4.9% of technology workers.



• Since many Latino students are the first in their family to attend college, they may have poorly developed goals or may not be adept at navigating the pathways between coursework and career success; hence they may be overwhelmed with the choices that confront them in college.

• The STEM professionals we interviewed noted that bilingual US Latinos can leverage their cultural understanding and communication skills to create and grow businesses in emerging foreign and domestic high technology and service markets.

• Nationally, Mexican immigrants are more likely to be self-employed in construction, private household care, landscaping services, child day care services, and restaurants. Self-employment in those fields is likely to be a function of their educational background and not necessarily of institutional barriers in other industries.

Therefore, an educational system geared to increasing awareness of STEM early on would likely result in more Mexican- and other Latino-origin entrepreneurs in those areas as those individuals realize that STEM is a viable option for them to achieve success in this country.

Recommendations

• Organizations such as the Illinois Technology Alliance (ITA), the Latino Technology Association (LTA), and Latino-focused education organizations should partner with the Illinois State Board of Education (ISBE) and a representative group of primary and secondary schools (public and private) with high Latino enrollments to develop and continuously improve practice guides for engaging Latino parents and students on why and how to plan for post-secondary education, especially in the STEM fields with emphasis on HT/IT.

Increasing awareness of STEM early on would likely result in more Latino entrepreneurs as they realize STEM is a viable option for them to achieve success in this country.

• Organizations such as ITA, LTA, the Society of Human Resources Managers, Illinois Chapter (SHRM-I), and partner post- secondary schools should support the expansion of career and education fairs in STEM and offer students a variety of opportunities to meet and work with human resources managers who hire STEM workers, with Latino college and graduate students in STEM, with Latino practitioners and professionals in STEM, and with Latino researchers and faculty in these fields.

• Given the very low percentages of Latinos in STEM, we believe that special attention needs to be given to the STEM achievement gap and that a special working group should be established within ISBE and partner schools on significantly raising the educational achievement of Latinos in math and science.

• LTA should partner with the Illinois State Board of Higher Education, the Illinois Community College Board, and a representative group of educators and counselors from Illinois public and private institutions and technical schools to improve practice guides and support services for Latinos in post-secondary education.

• LTA and other Latino-serving organizations should support statewide initiatives including the Illinois Monetary Award Program (MAP), Incentive for Access Grants, and Student Success Grants.

• Organizations such as ITA, LTA, and Illinois engineering and science schools and departments should jointly sponsor a STEM project fair for high school and college students.

• Organizations such as LTA, ITA, the Department of Commerce and Economic Opportunity, local development agencies, area and Latino chambers should convene and regularly host Latino networking gatherings and inventor/innovator forums.

• LTA should establish a recognition and awards event for Latino innovators and inventors in STEM and for exceptional student performance at high school and post-secondary levels.

• The Department of Commerce and Economic Opportunity, in cooperation with World Business Chicago and area and Latino chambers, should develop and maintain intelligence on Latino markets in the US and in Latin America.

• Organizations such as LTA, ITA, and the Department of Commerce and Community Affairs should develop and maintain a database of Latino-owned or operated production and service capabilities in Illinois able to serve high technology businesses and needs.

• LTA should serve as a conduit between venture capitalists focused on Latino markets and Illinois-based entrepreneurs willing to take on the risk for potential long-term rewards.

Introduction

The US economy is changing and Illinois must adapt in order to remain economically competitive. The latest GDP numbers show that Illinois is lagging behind other states in the change in GDP and that our share as part of the US economy is declining.[1] Illinois is twenty-first in the nation behind the Midwestern state of Minnesota (ranked eleventh) as well as the more populous states of California (4), New York (15), and Texas (20).[2] Illinois ranks higher in human capital investment (18), but behind the Midwestern states of Minnesota (5), Nebraska (11), and Iowa (17) and the more populous states of New York (6) and California (13).[3]

Latin America is, and will continue to be, a major trading partner with the United States and Illinois and shows promise as a growing new market for a broad range of technology-based products and services.

Future growth and expansion depend on the cultivation of a skilled workforce, especially in all areas of technology. We must do a better job of growing talent, especially in areas where we can achieve a competitive advantage. In order to do this we must take into account the fact that, simultaneous with the shift from an industrial economic base to a high technology and service base, the workforce itself has changed as a result of the rapid growth of the Latino population, which is comprised of a large number of immigrants who are often engaged in low-wage work. This demographic shift will have a profound impact on the labor market for decades to come, given that, as this report documents, fewer opportunities in STEM are available to youth living in low-income communities characterized by poor educational achievement.

This report arises from the need to understand the inter-relation between our changing economy and our changing workforce. How does the increased presence of Latinos in Illinois' workforce relate to our efforts to remain competitive in the new economy? We know that in order for Illinois to compete effectively in a high knowledge economy, its workforce must be well educated in science and mathematics. However, our state's ability to compete is hampered by persistently low test scores by Latino youth in these subjects and their very low participation rates in college-level science, technology, engineering, and mathematics (STEM). The result is that, despite comprising 13.6 percent of the total Illinois workforce (827,105 out of a total workforce of 6,087,756 workers), Latinos comprise only 4.9 percent of workers engaged in STEM (29,453 out of the STEM workforce of 604,150 workers). Overall, 9.9 percent of the Illinois workforce is employed in STEM occupations, but 3.6 percent of Latinos are employed in STEM.[4]

Nationally, Latinos are slightly more prominent in STEM occupations: 4.2 percent of Latinos are employed in STEM and comprise 5.6 percent of the overall STEM workforce. At the same time, a higher proportion of the US workforce, 10.1 percent, is in STEM, putting Illinois at a disadvantage when competing for technology-based businesses. Taking a strategic view, these differences are troubling simply on the basis of sheer numbers. The fastest growing segment of our population is significantly under-engaged in critical STEM fields.

From the standpoint of economic development, Illinois is losing a great opportunity to become a leader in meeting the technological needs of two of the fastest growing markets. On a global level, Latin America is, and will continue to be, a major trading partner with the United States and Illinois and shows promise as a growing new market for a broad range of technology-based products and services. For instance, Mexico is Illinois' second largest trading partner at $3.41 billion, and bilingual Latinos offer a unique opportunity to tap the $2.4 trillion market of the world's 21 Spanish-speaking countries.[5]

Latinos themselves also comprise a rapidly growing portion of the US consumer market, growing by an annual compound average rate of 7 percent (compared to 2.8 percent for the US as a whole) and accounting for $869 billion in purchasing power in 2008. One projection estimates that this purchasing power will top $1.3 trillion by 2012.[6] Net worth is also growing due to significant increases in the overall population as well as to improvements in average net worth. The net worth of Latinos as of 2006 is estimated to be $945 billion, an increase of 111 percent since 1996.[7]

It would be easy to conclude from the plain numbers that Illinois is well poised to take advantage of these trends, especially where bilingual communication and cultural competence provide a competitive advantage. Illinois is home to a diverse Latino population of nearly 1.9 million Latinos (out of a total population of nearly 12.8 million). They include a large community of those with Mexican ancestry and also significant numbers with origins in Puerto Rico, Cuba, Central America and South America. This diversity can be a great strength, but fair opportunities must be made available to Latinos for this potential to be realized.

As the state navigates through the greatest economic crisis in decades, traditional economic development strategies are giving way to those that emphasize scientific discovery, technological innovation, and the ability to translate existing know-how into new products and services. The state has a growing need for more scientists, engineers, mathematicians, technologists and skilled technicians who can drive development in high technology. Since the use and acceptance of science and technology is very much a function of cultural norms and social constructs, Illinois needs technological entrepreneurs who can identify and pursue new markets in underserved parts of the country and the world. But if Latinos are under-represented in STEM, Illinois will not be able to keep up, much less continue to lead, in industries that will serve the backbone of the new economy.

About This Report

The Illinois Department of Commerce and Economic Opportunity (DCEO) and the Illinois Workforce Investment Board (IWIB) are taking a strong interest in improving Illinois' standing in technology. At the same time as IWIB convened a special task force on information technology, DCEO made an investment in the advancing opportunities for Latinos in technology, which included making a grant to the Latino Technology Association (LTA). In late 2008 LTA, through a competitive bid process, invited the Institute for Work and the Economy, working in collaboration with the Institute for Latino Studies at the University of Notre Dame, to present a report covering five key issues:

• What is the participation of Latinos in high technology industries and occupations in Illinois? In particular, what is the participation of Latinos in information technology in Illinois? How do these participation rates in Illinois compare to Latino participation rates in other states with high Latino populations?

• What is the participation of Latino high technology entrepreneurs in Illinois? What is Latino entrepreneurship in information technology in Illinois? What are the factors that seem to contribute to their success?

• To what extent are Latinos academically prepared to pursue high technology careers? What is the consequence of the relative preparedness of Latinos in terms of career success in high technology?

• Are there barriers of entry to high technology businesses that are more closely associated with Latino entrepreneurs in Illinois? What are the consequences in terms of lost opportunities?

• Finally, what should be done to improve Latino participation in high technology—as researchers, as inventors and innovators, as entrepreneurs, as designers and producers, and as technologists and technicians?

In addition, the Information Technology Task Force invited LTA and this research group to provide information on the participation, opportunities, and challenges of Illinois Latinos in the information technology industry. This includes the full range of occupations from technical workers through product and software engineering and design to new business enterprises. The Task Force received a report in February 2009 that focused specifically on these issues. Several of the tables from that report may be found in Appendix A.

This report is divided into four sections. The first section summarizes what the literature and the data tell us about Latino incorporation into STEM. We supplement these findings with information that we gathered through conversations with high school–age students, adults who are attending computer technology courses, high school and college faculty and guidance counselors, Latinos who are professionals in STEM, human resources managers for STEM firms, and others who are engaged on the issue. The third section offers a brief discussion of our findings. The fourth section offers several recommendations based on our findings.

A Note on Terminology

Throughout this report we have elected to use “STEM” as a general overarching term that encompasses a variety of occupations in the fields of science, technology, engineering, and mathematics. There are a number of terms, variously defined, to describe sub-fields within STEM, including S & E (science and engineering), HT/IT (high technology & information technology), and S & T (science and technology). We have used these other terms to faithfully represent terminology used in the research we have reviewed. Otherwise, we give preference to the term “STEM.”

Illinois needs technological entrepreneurs who can identify and pursue new markets in underserved parts of the country and the world.

1. Findings: Literature Review

Our review of many data sources and studies speaks to four main areas: employment, education, family and social networks, and entrepreneurship.

A. Employment

While improvements are slowly being realized in the numbers of Latinos working in STEM occupations and in the share of STEM jobs held by Latinos, they do not approach the proportion of Latinos in the workforce. Illinois' economy has benefited from the growth in the number of Latinos but is taking little advantage of this in knowledge-based industries that are key to the state's long-term economic health.

• Latinos are under-represented in high technology and information technology (HT/IT) and in science and engineering (S & E) [8], including faculty positions at universities and colleges in the United States, wage-paying technical occupations, and advanced occupations.[9]

Latinos are under-represented in high technology and information technology and in science and engineering, including faculty positions at universities and wage-paying technical and advanced occupations.

• In 2007 Latinos age 18 or over comprised 13.2 percent of the US population (up from 11 percent in 2000) but were employed in only 5.5 percent of information technology jobs nationally (up from 4.9 in 2000; see Table 1) and only 5.8 percent of key non-IT high technology occupations (up from 4.8 in 2000).

• In 2000 and 2007 Latinos in Illinois comprised a lower share of IT workers than the national share (4.1 percent and 4.8 percent respectively). They also did less well in non-IT high technology employment than the nation as a whole in 2000 (4.1 percent), but grew at a faster than average rate in 2007 by growing their share to 7.9 percent (see Table 1).

TABLE 1. Latino Occupational Participation as a Percentage of the Workforce

	Illinois		United States	
	2000	2007	2000	2007
Core IT Occupations	4.1	4.8	4.9	5.5
Non-IT High Tech Occupations	4.1	7.9	4.8	5.8

Sources: American Community Survey, 2007; Census 2000

• Latinos in Illinois who are employed in information technology are as likely as non-Latino Whites to be self-employed (5.7 percent of Latinos and 5.6 percent of Whites) and are more likely to be in private sector jobs (88.2 percent of Latinos versus 84.7 percent of Whites; see Table 2).

TABLE 2. IT Occupational Distribution by Type of Employment and Race/Ethnicity in Illinois

	White	Black	Latino	Asian
Self-employed	5.6%	1.1%	5.7%	5.1%
Wage/salary	84.7%	83.5%	88.2%	92.5%
Government	9.7%	15.2%	6.0%	2.4%

Source: American Community Survey, 2007

• Latinos comprise 2.4 percent of tenured/tenure-track faculty members in college and university engineering programs. Latino tenured/tenure-track faculty members are concentrated in engineering management and in civil, environmental, chemical, mechanical metallurgical and materials, civil and environmental, and industrial and manufacturing disciplines.[10]

• Latinos comprised 5 percent of non-academic S & E occupational employment in 2005, up from 3 percent in 1980.

• African-Americans, Latinos, and American Indians/Alaska Natives with doctorates, combined, represented approximately 6 percent of employment in non-academic S & E occupations in 2005, up from 4 percent in 1990.

• Latinos in science and engineering (S & E) earn lower median salaries than all S & E workers, $60,000 for Latinos in 2003 compared to $66,000 for all S & E workers. Even controlling for age and years since degree, the median salary for Blacks, Latinos, and others in under-represented ethnic groups combined was nearly 18 percent below that of Whites and Asian/Pacific Islanders with bachelor's degrees, 14 percent with master's degrees, and 6.6 percent with doctorates.[11]

• A report in 2000 documents the under-representation of Latinos in science, engineering and technology in industry, local government, state government, federal government and education. Latinos tended to gravitate towards industry and towards education: 67 percent of Latinos in science, engineering, and technology were employed in industry and nearly 16 percent were employed in education. However, they comprised only 3.1 percent of those employed by educational institutions and 2.8 percent in industry.[12]

• In Illinois, keeping in mind that Latinos are broadly under-represented in high technology occupations, Latinos were slightly more concentrated than Whites in professional, scientific, management, and related industries, and in education, health, and social services. They were less concentrated in manufacturing and much less concentrated in finance, insurance, real estate, and rental and leasing (see Table 3; see also Table A-1 in Appendix A for comparisons with other states). The relatively small proportion of Latinos in IT manufacturing occupations in Illinois is noteworthy since Latinos nationally were concentrated more in all types of manufacturing (23 percent) than any other industry.

TABLE 3. Distribution of Workers in Top IT Industries by Race/Ethnicity

	Illinois		United States	
	White	Latino	White	Latino
Manufacturing	17.2%	15.4%	15.7%	13.4%
Information	7.9%	7.9%	9.3%	11.4%
FIRE*	15.1%	10.5%	10.7%	10.3%
Professional	31.1%	32.9%	34.4%	30.5%
Education	10.3%	12.1%	10.5%	6.7%

*Finance, Insurance, Real Estate, and Rental and Leasing
Source: American Community Survey, 2007

• Following its own review of the literature, the Tomás Rivera Policy Institute concluded that three major reasons for Latino under-representation in STEM careers are:

- student behavior characteristics, such as attitudes, aspirations, and academic preparation;
- school and institutional factors, such as availability or quality of pre-college curriculum and instruction, recruitment and retention programs, and financial aid; and
- family characteristics, such as socioeconomic status, parent involvement, family patterns, and cultural values.[13]

Minority students at schools in areas of concentrated poverty have less access to computers and limited access to the Internet, are less likely to use computers for complex forms of learning and have teachers who less frequently use computers for instructional purposes.

B. Education

Education is key to the development of a STEM workforce, yet Illinois is doing poorly with respect to the educational performance of Latinos, its fastest growing population segment.

• Latinos are at an educational disadvantage in pursuing careers in HT/IT and more broadly in STEM occupations as evidenced by low scores on standardized tests in mathematics and literacy.

• While the data do not track a cohort of students over time, the Illinois State Achievement Test and Prairie State Achievement examination provide a snapshot of Latino youth performance in reading, mathematics, and science in 2008. In each subject area and for every grade tested, Latinos substantially under-performed non-Latino Whites.

- 26 percent of Latino eighth graders were ranked below standard or worse in mathematics at the same time that 11 percent of non-Latino Whites received a similar ranking. A nearly identical result was seen in reading (26 percent of Latinos versus 12 percent of Whites).
- Latinos in the seventh grade did substantially worse than Whites in science: 33 percent of Latinos ranked below standard or worse compared to 11 percent of Whites.

• Educational intervention programs have been shown to be critical factors in increasing Latinos' entry into the STEM pipeline, and effective early childhood education programs and interventions in secondary school that provide access to a rigorous curriculum help widen the mouth of the STEM pipeline.

- Secondary education programs designed to move Latinos into the STEM pipeline have proven successful when they include an intensive monitoring program, an articulated program that reaches across grade levels, a sense of ownership among the students, and access to rigorous curriculum and sequential support.[14]
- Schools that target low-income high school students for math instruction as a gateway to STEM careers were successful in enrolling Latino students in higher level math courses without increasing the failure rate for students in these courses.[15]
- Comprehensive programs that provide continual support and services to students extending from the first to twelfth grades are more effective than segmenting programs that target age-specific students.[16]

• Other challenges also confront Latino youth:

- While Latinos have a more positive attitude toward information technology than non-Latino Whites, when controlling for factors such as education and income, Latinos have less exposure and use of information technology at home.[17]

- Concentrated poverty (not race) accounts for disparities in technology access for African-Americans and poor Whites, but low socioeconomic status does not entirely explain the difference between Latinos and other Americans as a predictor of low rates of access and use of information technology.[18]
- Minority students at schools in areas of concentrated poverty have less access to computers and limited access to the internet, are less likely to use computers for complex forms of learning or to create new knowledge (e.g., prepare spreadsheets, use word processor, make presentations), are more likely to use computers for games, and have teachers who less frequently use computers for instructional purposes.[19]
- Internet use among Latinos is considerably lower if Spanish is the only language spoken in the household.[20]

• Nationally, two out of three Latino youths pursue post-secondary education (including GED) by age 26 and more than 80 percent of those who complete high school go on to college by age 26 (the same rate as White high school completers). Latino undergraduates, however, are much less likely than Whites to complete a bachelor's degree by age 26. Approximately 64 percent of Latinos do not complete any degree by age 26, versus nearly 40 percent of Whites.[21]

• Latinos, Whites, and Blacks complete associate's degrees at about the same rate (12.8 percent for Latinos and 12.7 percent for Whites and Blacks). Latino bachelor's degree completion rates drop below Whites and Blacks: 23 percent of Latinos attain a bachelor's degree by 26, while 47 percent of Whites and nearly 30 percent of Blacks achieve this milestone.

• Among the best-prepared college students under age 26, nearly 60 percent of Latinos attend non-selective colleges and universities, compared to 52 percent of White students. Selectivity matters because it goes hand in hand with college completion: students attending more selective institutions are more likely to finish a bachelor's program. Although all groups experience lower graduation rates at non-selective colleges or universities, a comparison between the best-prepared White and Latino college students results in a substantial difference in completion rates: 81 percent for Whites versus 57 percent for Latinos.[22]

• In Illinois and the nation as a whole Latinos are less likely than Whites to achieve each successive educational milestone. Latino adults are four times more likely than Whites to have less than high school education. Latinos are also less likely to hold an associate's degree [23] and even less likely to have a bachelor's degree or higher (see Table 4; See also Table A-2 in Appendix A for comparisons with other states).

TABLE 4. Distribution of the Population 25 Years and Over by Educational Attainment and Race/Ethnicity

Highest	Illinois		United States	
Educational Level	White	Latino	White	Latino
Less than HS	9.6%	41.8%	11.1%	40.1%
HS Graduate	29.5%	29.3%	30.6%	27.8%
Some college or AS	28.6%	18.1%	28.3%	19.8%
BS or higher	32.3%	10.8%	30.0%	12.3%

Source: American Community Survey, 2005-2007

Both immigrant and native-born Latino parents hope their children will continue their schooling beyond high school and finish college. At the same time, parents and students are ill-equipped to navigate the complexities of college.

C. Family & Social Networks

A high school education is not sufficient for a career in STEM. Therefore, it is essential to understand the factors affecting Latinos' ability to successfully pursue post-secondary education. The literature shows that both immigrant and native-born Latino parents hope that their children will continue their schooling beyond high school and finish with a post-secondary degree. At the same time, parents and students are ill-equipped to navigate the complexities of college.

• A recent study by the Pew Hispanic Center reports that 95 percent of Latino parents say that it is very important that their children go to college. A majority also believe that young people have little chance of success without a college degree, but 43 percent believe that young people starting out today can succeed with just a high school degree because success depends on several other factors. In addition, native-born Latinos are more likely to say that young people need a college degree to succeed than foreign-born Latinos (60 percent versus 51 percent).[24]

• Among Latino parents, knowledge about how to advance to college is low according to a survey of 1,054 parents in Chicago, New York, and Los Angeles conducted by the Tomás Rivera Policy Institute.[25] The survey also revealed the following:

- Knowledge deficits were significantly greater among parents with lower income and educational backgrounds as well as among first-generation immigrants.
- Counselors, teachers, and college representatives may help to mitigate these deficits.
- Families and relatives can also play an important role in bridging the gap, but their influence may be limited if family members are scattered geographically or when there is little higher education experience.
- The internet and events such as college nights may also help, but the formal media do not appear to play a significant role in helping Latino parents acquire knowledge about college.
- Language barriers constitute an important challenge in the exchange of knowledge about college.
- Many parents in follow-up interviews and in the survey could not describe the details of entering and successfully completing a college program. Also missing from these interviews was any spontaneous expression that college would not only be used to get ahead but is increasingly important in staying even. The authors of the study suggested that this showed a lack of knowledge among these parents about the strategic value of a college education in a changing economy.

• Latino parents, both native born and immigrants, have great aspirations for their children. But given the low rates of post-secondary education among low-income Latino parents, especially immigrants, many cannot provide their children with meaningful guidance.

- They do not have a full understanding of the cost or value of a higher education.[26]
- They have limited knowledge about how to obtain financial assistance for their children.[27]
- Latino high school students often do not have a full understanding of the timeframes and sequence of activities required for entering STEM. That is,often the Latino student

will not seek and obtain guidance until the last year or two of the high school experience and will not be well informed about the steps that needed to have been taken beginning in the freshman year (e.g., advanced math, qualifying for Advanced Placement courses). By the time he student enters the twelfth grade, it is too late to go back and take the appropriate classes needed for IT.[28]

- Since Latinos are already under-represented in IT compared to non-Latino Whites they are less likely to know someone who can provide experiential insight.[29]

• Many low socioeconomic status Latino parents are not well informed about the difference between community colleges and four-year institutions. While not all IT careers require a bachelor's degree, the trend is in that direction. This is especially problematic given that Latinos tend to have the lowest degree completion rates and take the longest time to complete work towards a degree. The following are some of the challenges faced by Latinos:[30]

- Latinos are burdened by particular skills deficits. The foremost is weak preparation in math and the sciences.
- Since many Latino students are the first in their family to attend college, they may have poorly developed goals, may not be adept at navigating the path between coursework and career success; hence they may be overwhelmed by the choices that confront them in college.
- Family priorities may trump dedicated time or space for study and may require the student to contribute to family income through a job or by providing other home-related services (e.g., child care for a sibling). Parents may not under-stand what is required to be successful in college, and going away to college is often not supported.
- A recent study chronicles how key services such as tutoring, career counseling and advising, and personal counseling, make it possible for community college students to complete their studies.[31]
- Latino students may not receive sufficient student support services tailored to their needs.

• The State of Illinois has recently launched initiatives to address the transition between two-year and four-year institutions;[32] however, that transition still poses some challenges. Latinos tend to attend less selective institutions, which depresses the rate of downstream degree completion. In addition, community colleges are often more focused on increasing job skills, and many courses may not transfer to a four-year degree program. This is exacerbated by continued problems in articulation agreements (which allow the transfer of credits) between 2-year and 4-year institutions.

D. Entrepreneurship

Economic growth and diversification are driven largely by innovation and invention that are converted into new enterprises, but Latinos do not have a strong presence in STEM-based start-ups.

• Data show that Latinos have not been as likely as Whites to pursue self-employment in STEM. This is not especially surprising in light of the low rates and small numbers of Latinos achieving bachelors', masters', or doctorates in STEM fields.

• Immigrant Latinos are often thought of as a rich source of potential entrepreneurs. A recent study suggests that while immigrants are more pre-disposed to self-employment than native-born Americans, the foreign-born from developing countries (and many Latin

American countries are categorized as "developing") have lower self-employment probabilities than do US-born White Americans. This is in contrast to those who are from developed countries. These foreign-born have higher self-employment probabilities than do US-born White Americans and than do their foreign-born counterparts from developing countries.[33]

• Nearly 28 percent of engineering or technology companies in Illinois were founded by immigrants. Illinois ranks seventh in the country and ahead of the nation as to the proportion of high technology firms founded by immigrants.[34]

• Chicago ranks third in immigrant-founded start-ups as a percentage of total start-ups in technology centers (35.8 percent) behind Silicon Valley (52.4 percent) and New York (43.8 percent).[35]

• Two separate surveys of businesses owned by Korean, Mexican, African-American, and White owners show the following:[36]

- Mexicans (75.5 percent), African-Americans (78.8 percent), and Whites (82.8 percent) are much more likely to get into a small business by starting it themselves than by getting involved in some other way.
- Most Mexican, African-American, and White business owners have received some college education as well as training that resulted in certification.
- Approximately one-third of Mexican small business owners felt that ethnicity was a factor in being rejected for a job, and, of those, nearly 73 percent said that being rejected for a job motivated them to start or own their own business. In comparison, approximately 70 percent of African-Americans felt that their race was a factor in being rejected for a job, and, of those, 70 percent said that this motivated them to start or own their own business.
- Ten percent of Mexican small business owners and five percent of Koreans said that they thought that their ethnicity prevented them from obtaining finances for their business. Fifty-four percent of African-American small business owners thought that race blocked them from financing. Approximately two-thirds of small businesses owned by both Mexicans (61.7 percent) and African-Americans (68.8 percent) are located in their own ethnic communities. About one-fifth of Korean owned businesses were similarly located.

Latinos have not been as likely as Whites to pursue self-employment in STEM, since only small numbers of them achieve bachelor's, master's, or doctorates in STEM fields.

2. Findings: Community Conversations

We conducted a series of community conversations across northern and central Illinois in order to better understand the human dynamics behind the data we gathered. With participants ranging from Latino students to human resource managers in STEM businesses to Latino entrepreneurs, these conversations enriched our understanding of the challenges facing Latino youth in STEM fields. Please see Appendix C for more details on how the discussion groups were designed and conducted. Our key findings can be summarized as follows:

• The successful pursuit of STEM careers depends greatly on place and opportunity. Many of the students who are not pursuing STEM were unaware of the educational and employment opportunities that exist. Though some STEM students were inspired by a teacher, friend, or family member, most reported that they pursued STEM on their own initiative.

• Most students (high school and college) described a limited set of post-secondary educational options available immediately after high school, the main options being near-

community colleges and occasionally four-year institutions (if the student had an acquaintance or family member who attends a four-year institution). It is not clear whether this results from a general lack of knowledge about opportunities or whether it is a function of family economics. Several high school students in Chicago were less clear about the specific role of city colleges in their careers, but seemed to have the view that some college would help them maintain forward momentum.

• When asked about whether Latinos feel that they are the object of discrimination, none of the entrepreneurs and only one of the students expressed a view that being Latino is a barrier in and of itself. On the other hand, Latinos are concentrated in low-income neighborhoods, especially in the Chicago metropolitan area, and these neighborhoods also experience high rates of gang crime and significant failures in the education system. As a result, students talked about persistent pressures to join gangs, concerns about safety, lack of resources at school, indifference among teachers, and other conditions that put the idea of studying in STEM out of reach for many.

• Some students also described a mix of family circumstances that are common among Latinos, especially immigrant families. Women discussed feeling pressure to stay near home, thereby limiting their educational choices. Men spoke about feeling the need to quickly move into the workforce, either delaying entry into post-secondary education or having to combine work and learning. Both men and women talked about a mix of signals from their parents. Some parents were quite supportive of their children pursuing a post-secondary education. Others, often parents with little schooling beyond early secondary education, did not understand the need for post-secondary education and were indifferent to their children's decision to pursue further formal learning.

Women discussed feeling pressure to stay near home, thereby limiting their educational choices. Men spoke about feeling the need to quickly move into the workforce, either delaying entry into post-secondary education or having to combine work and learning.

• Some of the eleventh grade students we interviewed demonstrated a cursory knowledge of the details of completing a college program, especially in high technology. All spoke of the importance of pursuing a college education and either spoke about attending community college as a bridge to a four-year education or had ideas about how to pursue a four-year education directly. But none could describe in much detail the specifics of what it would take to be accepted into a four-year program, much less graduate with a degree in a specific area. Some spoke of siblings or other relatives who attend or have attended some college as important sources of information.

• Many students who are pursuing further education in STEM, either in two-year or four-year programs, demonstrated remarkable persistence and a strong aptitude in researching their options and in charting a workable plan towards achieving their goals.

• Many students and STEM professionals spoke about the challenges in sorting out how they could finance their post-secondary education. Several of the STEM professionals were able to secure scholarships, either academic or athletic. Students currently enrolled in post-secondary programs described their difficulties in discovering and applying for grants, scholarships, and low-cost loan programs.

• Human resources managers with whom we met perceived the primary challenges facing Latino youth to be their limited knowledge of opportunities and their tendency to overlook the connection between good careers in the future and achieving a solid foundation in English, mathematics, and science in the present. Some managers think that improving the situation is a matter of providing more information about career opportunities. Some also believe that Latino youth have a somewhat more limited view of their world and opportunities as a result of a strong family-oriented culture, few role models in STEM occupations, and a Latino youth culture that seemingly is based on unhealthy images. They believe that the challenges can be addressed. Programs that put technology in the hands of Latino youth seem to generate new interest in STEM. Students who are enrolled in technical education programs appear to have higher retention and completion rates.

• Latino entrepreneurs in STEM voiced the opinion that people are rewarded in STEM on the basis of their talent and their accomplishments. None expressed the view that opportunities for which they were qualified were subsequently denied to them based on their ancestry. When asked about access to venture capital, they noted that most venture capital is concentrated on the nation's two coasts, especially the west coast in STEM, and that this depresses the formation of STEM ventures in the Midwest generally.

• The STEM professionals noted that the competitive advantage of Latinos is seen in the growing domestic and foreign Latino high technology products and services markets. They believe that Latinos in the United States, presumably those who are bilingual, will be able to leverage their understanding of customs and cultures and their ability to communicate in English and Spanish to create and grow businesses in emerging markets.

3. Discussion

A. Employment

The proportion of Latinos in STEM occupations is much smaller than the proportion of Latinos in the workforce as a whole. This report makes the case that the relatively poor performance of Latinos in science and mathematics in grades K–12 and relatively low rates of entry by Latinos in STEM post-secondary programs result in relatively low employment rates. The added question is whether there is evidence of additional challenges in Illinois attributable to discrimination. The answer is that we simply do not know. Although one person we interviewed described the world of STEM as being a "meritocracy," we can also cite anecdotal cases where being Latino is a disadvantage in the job market. We also note that Latinos tend to gravitate more than non-Latino Whites to non-selective post-secondary institutions. It is possible that while Latinos and non-Latinos may be judged on their merits, the differences in the perceived quality of education skew the better opportunities towards those who attended more selective post-secondary institutions. While there may be no direct evidence of discrimination, the accumulated effect of disadvantages creates a de facto barrier to the better STEM jobs and career pathways.

While there may be no direct evidence of discrimination, the accumulated effect of disadvantages creates a de facto barrier to the better STEM jobs and career pathways.

B. Education

Time and money pose great challenges for all youth of modest means or whose families live in poverty. Since a very large segment of Latino immigrant and first-generation American born families are concentrated in low-income groups, Latino youth must balance education with a need to work and help their families. This is seen among many high school dropouts and those who pursue an alternative high school curriculum. It is also seen in the fact that Latinos who pursue a post-secondary education are disproportionately concentrated in community colleges and private career schools—the former because of cost and both because they offer an education that leads directly to employment.

Those who use community college as a pathway to a four-year education and beyond face many hurdles, including losses in credit transfers, greater overall expense, the time and commitment required to finish a four-year degree, and greater inflexibility (as compared to community colleges) on the part of four-year institutions to accommodate the needs of those who must work and learn.

One of the challenges to opening Latinos to the opportunities in STEM is to increase the perception that a career in STEM beyond technical work is achievable. Private career schools are adept at shaping their services to meeting the needs of the market, and they have been aggressive in targeting Latinos. Unfortunately, these schools often offer terminal certificates or degrees that are not accepted for more advanced education. Four-year schools are less market-driven and may be perceived as being out of reach. It is important that Latinos understand that their opportunities may extend beyond a technical education and that they need to plan accordingly.

Real improvements can be made if significant focus is given to those who are in post-secondary education or about to move into post-secondary education. Self-help and school-provided mentoring and guidance services can reduce post-secondary dropout rates and improve completion rates.

C. Family & Social Networks

High school guidance counselors and others who advise Latino youth need to be made more aware of the challenges and solutions faced by Latinos.

Place plays a critical role. Many Latino youth live in areas that suffer persistent under-investment in education and after-school learning programs. They often have a very limited network of mentors and advisors among family and friends who can help guide them through school and who may advise them of their opportunities. Until the time that such an internal network can be created as more Latinos pursue and obtain degrees in STEM fields, Latinos must rely on an array of resources that help bridge them over. These include a committed group of high school and college counselors, faculty mentors, other students, and community role models. High school guidance counselors and others who advise Latino youth need to be made more aware of the challenges and solutions faced by Latinos. There is some evidence that the educational self-confidence of Latinos and other students who are at the vanguard in pursuing a post-secondary education is severely tested, especially in mathematics and science, and that faculty, counselors, and self-help groups are important to overcoming this challenge.

Parents are key to opening opportunities for Latino youth, but they often do not know about these opportunities nor about the means for achieving long-term career goals. The challenge for parents whose children will be the first to go beyond high school is that these parents often have a very limited understanding of the academic, financial and time commitments and the pathways for achieving a post-secondary degree. In addition, they may not understand the differences in value between a technical certificate, an associate's degree, a bachelor's degree, or an advanced degree (master's or doctorate) and may not understand why their children may decide to continue pursuit of their academic interests.

Latinos face many cultural challenges that, while not unique, are a reality of family and community life. For example, Latino families are close-knit. As a result, there is a tendency for many Latino parents to discourage their children, especially young women, from leaving home to go to school. In addition to expense, this accounts for why many Latinos prefer to attend nearby community colleges rather than residential college campuses. In addition, women also are expected to focus their life's work on child-rearing and taking care of the home. While economic realities and the effect of American culture on Latino families are rapidly expanding opportunities for Latino children, the effects of Latino culture remain relatively strong.

D. Entrepreneurship

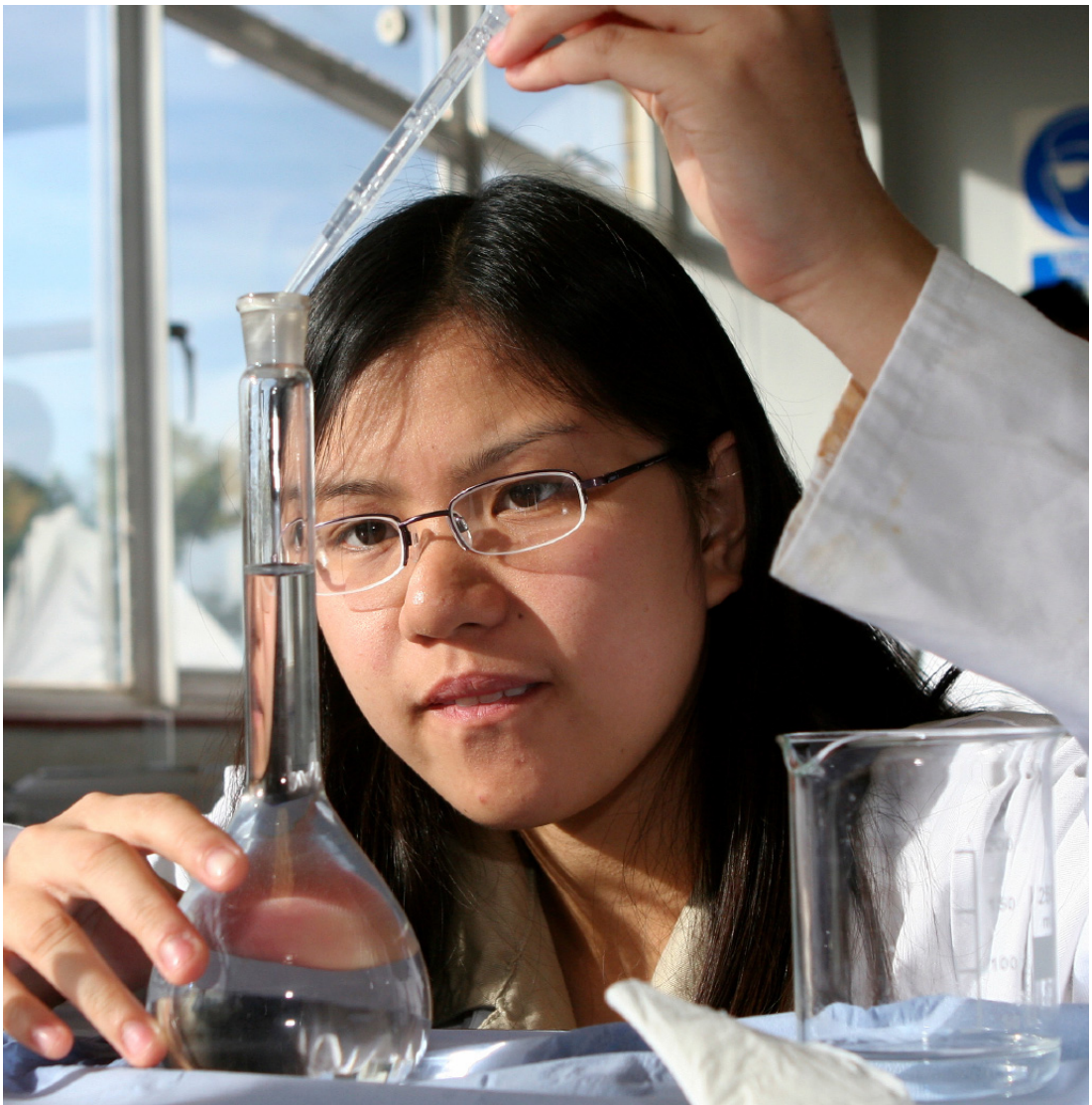
Latinos in STEM appear to prefer wage-paying jobs. They are under-represented in new high technology ventures. In addition, while it makes sense that Latinos entrepreneurs in high technology would have a competitive advantage in the burgeoning Latino market in the United States and generally throughout the hemisphere, there is not a critical mass of innovators and investors to support the rapid growth of Latino-led high technology ventures that serve that market.

As mentioned above, a recent study about the impact of immigrants' home country economic status on the probability of self-employment in the US (Uwaifo Oyelere and Belton, 2009) finds that immigrants from developed countries tend to engage in self-employment

at a higher rate than those from developing countries.[37] The study's results disagree with previous research suggesting that immigrants are more likely to be entrepreneurs if coming from countries with high levels of self-employment. The authors explain this discrepancy by theorizing that despite high self-employment in the home country, if institutions are not similar, the transfer of the skill and knowledge might be slower despite previous exposure to self-employment. Additionally, Uwaifo Oyelere and Belton conclude that self-employment may be a possible pathway for assimilation and integration into the formal labor sector, in particular, for immigrants from non-English speaking countries.

In the case of Illinois, two of the top three immigrant-sending countries also have high self-employment rates in the country of origin (Mexico and the Philippines), but both of these countries are classified as developing nations (see Table A-3 in Appendix A). This leads to the expectation that immigrants from these countries may not have experience with institutional models on how to build successful STEM-related businesses. Nationally, Mexican immigrants are more likely to be self-employed in non-STEM fields such as construction, private household care, landscaping services, child day care services, and restaurants.[38] Self-employment in those fields is likely to be a function of educational background and not necessarily institutional barriers in other industries. Therefore, an educational system geared to increase awareness of STEM early on would likely result in more Mexican and other Latino-origin entrepreneurs in those areas as those individuals realize that STEM presents viable options for them to achieve success in this country.

There is not a critical mass of innovators and investors to support the rapid growth of Latino-led high technology ventures that serve that market.



4. Recommendations

STEM educational outcomes may be improved based on awareness, skills and knowledge, and institutional and programmatic opportunities

In considering what actions can be taken to stimulate Latino participation in STEM we took a practical approach, focusing on those areas where the public and private sectors can work in collaboration to achieve measurable results. The recommendations below are discrete projects with short-term return targeted at existing organizations and institutions that do not require reorganization or policy changes. This emphasis led us to focus on the areas of education and entrepreneurship.

A report by the GE Foundation provides a useful and powerful framework for improving STEM educational outcomes based on three factors:

• **Engagement:** having an awareness, interest, motivation, and orientation to the sciences or quantitative disciplines.

• **Capacity:** having the skills and knowledge to advance in the sciences or quantitative disciplines.

• **Continuity:** having the institutional and programmatic opportunities, material resources, and guidance to support advancement in the sciences or quantitative disciplines.[39]

The recommendations on K–12 and post-secondary education, taken collectively, attempt to address aspects of these three elements of the GE Foundation framework.

A. K–12 Education

• Family plays an important and continuing role in the lives of Latino youth and the route to Latino youth is through their parents. Organizations such as the Illinois Technology Association (ITA), the Latino Technology Association (LTA), and Latino-focused education organizations should partner with the Illinois State Board of Education (ISBE) and a representative group of primary and secondary schools (public and private) with high Latino enrollments to develop and continuously improve practice guides for engaging Latino parents and students on why and how to plan for post-secondary education, especially in the STEM fields.

• A persistent message through our interviews and in the literature is that Latino youth do not know about the opportunities that may exist in STEM. One way to address that is bring the full range of opportunities to them so that they may see what is possible. Therefore, organizations such as ITA, LTA, the Society of Human Resources Managers, Illinois Chapter (SHRM-I), and partner post-secondary schools should support the expansion of career and education fairs in STEM and offer students a variety of opportunities to meet and work with human resources managers who hire STEM workers, with Latino college and graduate students in STEM, with Latino practitioners and professionals in STEM, and with Latino researchers and faculty in these fields.

• ISBE, local school agencies, and the youth councils of local workforce investment boards should take an active role in developing and supporting STEM-related after-school, summertime, and school-to-work initiatives. Local chambers, state technology associations such as LTA and ITA, and area businesses must also become involved through volunteer mentors and financial sponsorships.

• A good foundation in mathematics and science is a necessary condition for advancement in STEM. There are undoubtedly many educational task forces addressing the education gap for Latinos and African-Americans. Given the very low percentages of Latinos in

STEM, we believe that special attention needs to be given to the STEM achievement gap and that a special working group should be established within ISBE and partner schools on significantly raising the educational achievement of Latinos in math and science.

B. Post-Secondary Education

• In order to improve self-confidence in math and science and provide guidance and support on financial assistance and family support services (for those students who must also support their families), on job and career opportunities (especially as faculty in higher education), and on further graduate-level study, LTA should partner with the Illinois State Board of Higher Education, the Illinois Community College Board, and a representative group of educators and counselors from Illinois public and private institutions and technical schools to improve practice guides and support services for Latinos in post-secondary education.

Organizations should convene and regularly host Latino networking gatherings and inventor/innovator forums, and establish recognition and awards events for Latino innovators and inventors in STEM and for exceptional student performance.

• The research also shows that the persistent poverty experienced by many Latinos in Illinois takes away educational choice and, therefore, employment opportunities. LTA and other Latino-serving organizations should support statewide initiatives such as the Illinois Monetary Award Program (MAP), Incentive for Access Grants, and Student Success Grants.

• Building on the idea that knowing and seeing opportunities motivates students to excel, organizations such as ITA, LTA, and Illinois engineering and science schools and departments should jointly sponsor a STEM project fair for high school and college students.

C. Entrepreneurship

Finally, there is no quick formula for creating a new class of entrepreneurs. There are, nevertheless, ways in which entrepreneurship may be nurtured and grown. Programs such as Celebra la Ciencia, for example, increase Latino family participation in science and health education programs through collaborations between local museums, community organizations, businesses, schools, colleges and universities, and the media. Project Exploration, which hosts Celebra la Ciencia, provides minority youth and girls with a broad range of experiences in science and with scientists. But more needs to be done. This may be accomplished through the following recommendations:

• In order to stimulate the growth and development of new products, services, and markets, organizations such as LTA, ITA, the Department of Commerce and Economic Opportunity (DCEO), local development agencies, area and Latino chambers should convene and regularly host Latino networking gatherings and inventor/innovator forums.

• DCEO, in cooperation with World Business Chicago and area and Latino chambers, should develop and maintain intelligence on Latino markets in the US and in Latin America.

• Organizations such as LTA, ITA, and DCEO should develop and maintain a database of Latino-owned or operated production and service capabilities in Illinois able to serve high technology businesses and needs. The aim here is to make this information a key element in presentations to possible investors in Illinois and to possible buyers of Illinois services and products.

• While venture capital is concentrated heavily on the two US coasts, there is an opportunity to redirect some of that capital to the Midwest by encouraging investment in Illinois-based ventures focused on Latino markets and entrepreneurship. LTA should serve as a conduit between venture capitalists focused on Latino markets and Illinois-based entrepreneurs willing to take on the risk for potential long-term rewards.

• Finally, it is important to recognize Latinos who are at the “bleeding edge” of business and scientific and technological innovation. They go beyond role models and address directly the need for visionaries within the Latino communities. LTA should, therefore, establish a recognition and awards event for Latino innovators and inventors in STEM and for exceptional student performance at high school and post-secondary levels.

Appendix A: Supplementary Tables

TABLE A-1. Distribution of Workers in Top IT Industries by Race/Ethnicity and State

	Illinois		California		Florida		New York		Texas	
	White	Latino	White	Latino	White	Latino	White	Latino	White	Latino
Manufacturing	17.2%	5.4%	19.3%	20.5%	9.4%	9.5%	13.0%	7.8%	16.3%	11.9%
Information	7.9%	7.9%	11.1%	11.3%	9.6%	8.4%	9.4%	10.3%	9.6%	11.0%
FIRE*	15.1%	10.5%	7.3%	8.9%	7.8%	12.0%	17.6%	14.5%	9.2%	10.2%
Professional	31.1%	32.9%	36.9%	23.9%	37.6%	37.7%	32.0%	34.0%	34.1%	25.7%
Education	0.3%	12.1%	8.1%	13.2%	12.1%	11.9%	10.5%	10.9%	9.4%	15.1%

*Finance, Insurance, Real Estate and Rental and Leasing

Source: American Community Survey, 2005-2007

TABLE A-2. Distribution of the Population 25 Years and Over by Educational Attainment, Race/Ethnicity, and State

	Illinois		California		Florida		New York		Texas	
	White	Latino	White	Latino	White	Latino	White	Latino	White	Latino
Less than HS	9.6%	41.8%	7.6%	44.5%	10.7%	27.5%	10.2%	36.0%	9.8%	44.3%
HS Graduate	29.5%	29.3%	22.1%	26.1%	31.5%	28.5%	29.6%	29.5%	26.6%	26.6%
Some college or AS	28.6%	18.1%	32.9%	19.9%	30.0%	23.2%	24.3%	19.6%	31.0%	18.7%
BS or higher	32.3%	10.8%	37.4%	9.6%	27.8%	20.7%	35.9%	14.9%	32.6%	10.4%

Source: American Community Survey, 2005-2007

TABLE A-3. Self-Employment Rates in Country of Origin Ranked by Foreign-born Population in Illinois

	In Country of Birth		In Illinois	
Country	Year	Self-Employment Rate*	Foreign-born population**	Percentage
Mexico	2004	0.403	708,323	40.52%
Poland	2007	0.192	154,113	8.82%
Philippines	2007	0.553	83,575	4.78%
Korea	2004	0.366	46,453	2.66%
Germany	2007	0.119	29,705	1.70%
Italy	2007	0.238	23,658	1.35%
Ukraine	2003	0.124	20,993	1.20%
Guatemala	2004	0.446	20,777	1.19%
Canada	2004	0.154	20,773	1.19%
Pakistan	2003	0.373	19,656	1.12%
United Kingdom	2003	0.039	18,949	1.08%
Greece	2005	0.375	18,662	1.07%
Romania	2004	0.341	18,095	1.04%
Russia	2004	0.076	16,757	0.96%
Japan	2004	0.148	10,755	0.62%
Ireland	2004	0.201	9,540	0.55%
Honduras	2001	0.388	8,225	0.47%
Czech Republic	2004	0.168	7,089	0.41%
Thailand	2000	0.545	6,239	0.36%
Israel	2004	0.144	4,594	0.26%
France	2004	0.116	4,269	0.24%
Argentina	2004	0.279	3,828	0.22%
Croatia	2004	0.209	3,774	0.22%
Hungary	2004	0.150	2,921	0.17%
Netherlands	2004	0.121	2,670	0.15%
Ethiopia	2004	0.495	2,632	0.15%
Indonesia	2003	0.345	1,792	0.10%
Panama	2004	0.265	1,713	0.10%
Bolivia	2000	0.704	1,629	0.09%
Australia	2004	0.129	1,514	0.09%
Uruguay	2004	0.294	999	0.06%
Portugal	2004	0.262	468	0.03%

Countries in bold are classified as developed nations by the World Bank.

** Source: Labor Force Survey, International Labor Organization Bureau of Statistics*

*** American Community Survey, 2005–2007*

Appendix B: Recommendations for Further Research

Place not Race?

The research that we cite indicates that place and not race offers the most compelling explanation for the poor performance of students in mathematics and literacy. But it also notes that it makes a difference if the students are Latinos and that some of the poor performance is linked to being Latino.

Three important questions that arise from this research. First, it is not clear whether this describes the experience of Latinos in Illinois, since the study is a national one and includes areas of the country where discrimination against Latinos is obvious and institutionalized.

Second, if this relationship also exists in Illinois, the study does not explore the reasons behind this association. Is it tied to the high proportion of Latinos who are immigrants and who speak Spanish as their primary language? If this is true, can this be seen in other immigrant, non-English speaking populations. Or are there other social and cultural factors that are specific to Latino society in Illinois that explain the difference?

Latinas show higher general enrollment than Latino men (6.4% versus 4.8%). However, in Computer and Information Science enrollment, Latino men account for 5.8% versus 2.8% for Latinas.

Third, we do not know whether students in low-income immigrant and first-generation American communities where many Latinos are concentrated have access to the breadth and depth of courses in mathematics and sciences that provide the proper educational foundation for advancement in STEM. How do course offerings in Latino communities compare to those offered in other minority communities and in communities that are more prosperous or are majority White?

Therefore, it would be valuable to replicate and expand the above-mentioned research in Illinois and, if place does not fully explain the experience of Latinos, drill down as to what other factors are related to this issue.

Communicating with Latino Youth

The report argues that more and better information needs to be put in the hands and minds of Latino youth, but we can only guess what methods may be most effective. Many innovative programs are being tried, including youth peer-to-peer tutoring and mentorships, but nothing approaching a methodologically sound experiment is being done on a broad scale. Therefore, we propose that a representative set of informational interventions, ranging from those targeting parents to those aimed directly at youth, be tested rigorously.

STEM and Cultural Diversity

The report makes several assertions about the need for more Latinos in STEM largely on the basis of needing sheer numbers and also addressing the market opportunity. This raises a number of underlying questions about how diversity in STEM can be connected to greater innovation and entrepreneurship:

• How does culture make a difference in opening new markets within under-served communities?

• Can the Latino market for STEM-generated products and services be differentiated effectively from other markets?

• Does it take a special knowledge and understanding of Latino-differentiated markets to serve them properly?

Each of these merits its own independent study; however, altogether they get at fundamental precepts about the development of STEM-driven economy.

STEM as Meritocracy?

Some say that STEM is a meritocracy, but is there evidence to back it up? Is there direct STEM-employment discrimination in Illinois that adversely affects Latinos and African-Americans, or is there an accumulated effect of persistent under-investment and low achievement that may adversely affect advancement in these fields?

Venture Capital

Is there a role for venture capital that is targeted to supporting Latino entrepreneurship in STEM products and services? What evidence is there to support this idea—and does it have merit?

Latina Entrance into STEM

What kind of further study can be done to explain and improve the enrollment and completion rate for Latinas in STEM post-secondary programs? Women in general are enrolled in post-secondary education in greater numbers than men. According to the US Department of Education, women accounted for around 58 percent of the post-secondary degree recipients at the bachelor's and master's levels in the 2002–2003 academic year. But at the PhD level that number drops to 47 percent.

According to the Illinois Higher Board of Higher Education Fall Enrollments & Degrees System for 2003, as a percentage of total enrollments Latinas show higher general enrollment than Latino men (6.4 versus 4.8 percent). However, in Computer and Information Science in that same year the enrollment numbers are quite different. Latino men account for 5.8 percent of the total number of enrollees but Latinas account for only 2.8 percent.

Some say that STEM is a meritocracy, but is there evidence to back it up?

Latina Attrition in STEM

New research has found that 52 percent of women entering the US corporate science, engineering and technology (SET) workforce leave their jobs because of gender-related issues. Reducing female attrition rates by 25 percent in SET fields would add 220,000 highly qualified workers to the labor market.[40] New private sector initiatives seek to stop the flow of women out of SET. More research is needed regarding the effectiveness of these programs not only to retain women in the workforce but also to attract more, especially minority women, including Latinas, to SET occupations.

Appendix C: Methodology for Community Conversations

Between April and July 2009 we conducted a series of thirteen community conversations throughout northern and central Illinois in an effort to ascertain the scope of experiences that describe not only barriers but also strategies for success among Latinos entering into technology fields. The design attempted to provide a format ample enough to capture the breadth of experience of Latinos in STEM fields. The participants included Latino high school and college students, high school and college STEM instructors teaching Latino youth, human resource managers who hire workers into STEM positions, and Latino entrepreneurs in STEM.

Below we have listed the schedule and characteristics of the participating groups as well as the instrument used to facilitate the discussion.

Schedule and Characteristics of Participating Discussion Groups

1. Two meetings with high school age Latino students in an urban setting (Chicago and near-in suburbs) recruited from community organizations:

Central States SER, Little Village, Chicago IL
April 7, 2009
7 juniors at Farragut High School

April 28, 2009
6 GED students

2. Two meetings with Latino workers in workforce development training:

Instituto del Progreso Latino, Pilsen/Little Village, Chicago IL
April 22, 2009
9 students in ESL computer group

April 24, 2009
4 students in the Office technology group

3. Two meetings with high school–age Latino students in a suburban setting, recruited from community organizations:

Workforce Network, Peoria IL
May 28, 2009
3 high school students
1 college student
1 high school graduate considering enrolling in helicopter training program as part of the National Guard service.

Moline Boys & Girls Club, Moline IL
June 3, 2009
5 high school–age students
1 college-bound student

4. Two groups of Latino students in technical or community college programs related to HT/IT:

DeVry University, Chicago IL
May 28, 2009
4 associate's students (first session)
5 associate's/bachelor's students (second session)

5. One meeting with Latino students in 4-year college/university or graduate program studying in HT/IT:

161 N. Clark St., Chicago IL
June 19, 2009
4 Mechanical engineering students from **Northern Illinois University**

6. One meeting with HR professionals hiring HT/IT workers:

Teleconference
April 28, 2009
8 members of the Illinois chapter of the **Society for Human Resources Management (SHRM)**

7. One meeting with venture capitalists in IT/HT & Latinos HT/IT professionals and entrepreneurs:

161 N. Clark St., Chicago IL
April 27, 2009
2 entrepreneurs & professionals

Teleconference
5 entrepreneurs & professionals
May 27, 2009

8. One meeting with high school/college advisors on prospects for Latinos in HT/IT:

Union League Club, Chicago IL
April 24, 2009
1 engineering college
professor
1 high school principal
2 high school IT coordinators

9. One meeting with five high school age students participating in a summer youth program operated by the River Valley Workforce Investment Board:

Elgin Community College
Elgin IL
July 2009

Instrument for Discussion Groups

We developed a foundational instrument to be used with various types of groups along the spectrum from Latino STEM students to entrepreneurs in the various occupations and industries that depend on technology. The following instrument presents the type of questions used to promote discussions amongst the various groups.
High school level students:

1. What do they perceive as available employment and educational options?
2. What is their world of possibilities?
3. What is the relevance of science, math and technical education?
4. What is the perception of their social network with respect to employment and educational options?
5. What is the perception of their social network towards science, math and technical education?
6. What are their parents' perceptions with respect to employment and educational options for them?
7. What are their parents' perceptions with respect to science, math and technical education?
8. Of those students who are interested

STEM educational outcomes may be improved based on awareness, skills and knowledge, and institutional and programmatic opportunities

in science, technology or mathematics, what do they see as obstacles? Their own challenges? Challenges imposed by others?
9. What do their teachers say about opportunities in employment and education?
10. What do their teachers say about STEM?
11. Are their teachers supportive or limiting?

College and post-secondary technical students:

1. Parallel high school–level questions as retrospective questions: what were their senses of things as high school students?
2. What do they perceive to be their futures? Hopes? Expectations?
3. Those pursuing STEM? linked careers, either after technical school or beyond
    a. What led them to decide to pursue STEM?linked careers?
    b. What do they hope to have as a career path?
    c. What do they expect to achieve career? wise?
    d. What are the barriers/ opportunities?
    e. Is being Latino a factor one way or another?

Professionals/entrepreneurs:

1. Describe pathway to current position.
2. Barriers/obstacles/opportunities/ mentors/guides?
3. Importance of networks:
    a. Obtaining employment
    b. Obtaining venture capital and business services (banking, professional services, etc.)
    c. Role of Latino networks? Professional networks? Other social/educational/intellectual networks?
    d. Has system changed? If so, how?
    e. Does the identity of Latino make a difference?

HR Professionals who hire high-tech workers:

1. Preparedness of Latino candidates/workers with respect to high tech occupations
2. Barriers to employment in high tech jobs
3. Opportunities/advantages to employ ment in high tech jobs?
4. Any distinctions between Latino/ non?Latino immigrant and native? born workers?
5. Sources of recruitment of Latino workers?
6. Special distinctions that put Latino workers at advantage/disadvantage?
7. Relative success/lack of success of Latino workers? Reasons?

Notes

[1] Bureau of Economic Analysis, Press Release (June 2, 2009), http://www.bea.gov/newsreleases/regional/gdp_state/2009/gsp0609.htm.

[2] Ross DeVol and Anita Charuworn with Soojung Kim, State Technology and Science Index: Enduring Lessons for the Intangible Economy (Milken Institute, June 2008), 2.

[3] Ibid., 34. This ranking is "a measure of each state's stock of human capital and the rate of investment (flow) between states by gauging the concentration and momentum of various science and engineering fields. It also tries to capture how well R&D investments are being utilized by analyzing student scores" (31).

[4] Source: Author's analysis of American Community Survey, 2005–2007.

[5] Sylvia Puente and Berenice Alejo, Forging the Tools for Unity (Notre Dame: Institute for Latino Studies, 2007), 8.

[6] Juan B. Solano. The US Hispanic Economy in Transition: Authoritative Portrait of the Growing Hispanic Market, Special Report (2006), 3.

[7] Ibid.

[8] Information technology (IT) is comprised of the following occupations: computer and information scientists; research, computer programmers; computer software engineers, applications; computer software engineers, systems software; computer support specialists; computer systems analysts; database administrators; network and computer systems administrators; network systems and data communications analysts; computer specialists, all other; computer and information systems managers; technical writers; electrical engineers; electronics engineers, except computer; computer hardware engineers; electrical and electronic engineering technicians; electrical and electronics drafters; computer operators.

High technology (HT) is comprised of the following occupations: aerospace engineers; biomedical engineers; chemical engineers; mining and geological engineers; nuclear engineers; petroleum engineers; aerospace engineering and operations technicians; electro-mechanical technicians; biochemists and biophysicists; microbiologists; epidemiologists; medical scientists, except epidemiologists; astronomers; physicists; atmospheric and space scientists; chemists.

The National Science Foundation publishes an annual report on science and engineering (S & E) indicators. It uses three definitions for scientists and engineers: occupation (individuals employed in science and engineering classified jobs); highest degree; need for science and engineering knowledge in their jobs.

[9] Source: Author's analysis of 2007 American Community Survey.

[10] Michael T. Gibbons, Engineering by the Numbers (American Society for Engineering Education, 2007), 32, 34

[11] National Science Board, Science and Engineering Indicators 2008 (Arlington, VA:

National Science Foundation, 2008), NSB 08-01 vol. 1, 30. These gaps narrow further when also controlling for field of degree, occupation and employer characteristics and family and other personal characteristics. The evidence suggests that Latinos may behave more like non-Latino Whites, especially with respect to field of degree, and therefore controlling for these elements may not be representative of the experiences of Latinos.

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13 Maria Teresa V. Taningo, Ann Bessie Mathew, and Harry P. Pachon, STEM Professions: Opportunities and Challenges for Latinos in Science, Technology, Engineering, and Mathematics—A Review of the Literature (Claremont, CA: Tomás Rivera Policy Institute, 2008), 2–3.

14 Patricia Gándara, et al., "Capturing Latino Students in the Academic Pipeline, " Rep. no. 1, (Sacramento, CA: Chicano/Latino Policy Project, 1998).

15 Howard T. Everson and Marlene D. Durham, Signs of Success—Equity 2000: Preliminary Evidence of Effectiveness (College Examination Board, 1996).

16 Patricia Gándara, "Strengthening the Academic Pipeline Leading to Careers in Math, Science, and Technology for Latino Students," Journal of Hispanic Higher Education 5 (2006): 222.

17 Karen Mossberger, David Kaplan, and Michele A. Gilbert, "Going Online without Easy Access: A Tale of Three Cities," Journal of Urban Affairs 30, no. 5 (2008).

18 Paul Leonardi, "Problematizing 'New Media': Culturally Based Perceptions of Cell Phones, Computers, and the Internet among United States Latinos," Critical Studies in Media Communications 20, no. 2 (2003): 160; Mossberger, Kaplan, and Gilbert, "Going Online Without Easy Access," op. cit. n. 17.

19 Richard P. Durán, "Technology, Education, and At-Risk Students," in the Yearbook of the National Society for the Study of Education (National Society for the Study of Education, 2005), 210.

20 Hiroshi Ono and Madeline Zavodny, "Immigrants, English Ability and the Digital Divide," Social Forces 86, no. 4 (2008): 1455.

21 Richard Fry, Latino Youth Finishing College: The Role of Selective Pathways (Pew Hispanic Center, 2004), 2.

22 Ibid., vi. To illustrate the significance of these findings, the Pew Hispanic Center conducted a simulation assuming that Latinos attended the same kind of colleges as similarly prepared Whites in the same cohort. The projected result is a 20 percent increase in the number of bachelor's degrees. Assuming no change from the pathway undertaken by Latinos in the National Educational Longitudinal Study cohort, but assuming that Latinos graduate from college at the same rate as their White peers, the result is a 42

percent increase in graduation rates.

23 Only a quarter of those in the "Some college or AS" category in both Illinois and the United States, either Whites or Latinos, hold an associate's degree.

24 Pew Hispanic Center/Kaiser Family Foundation, National Survey of Latinos: Education (January 2004), 9.

25 Louis G. Tornatzky, Richard Cutler, and Jongho Lee, College Knowledge: What Latino Parents Need to Know and Why They Don't Know It (Claremont, CA: Tomás Rivera Policy Institute, 2002), 5.

26 Ibid.

27 Ibid.

28 Ibid., 10.

29 Ibid., 11.

30 Louis G. Tornatzky and Elsa E. Macias, Access and Achievement: Building Educational and Career Pathways for Latinos in Advanced Technology (Claremont, CA: Tomás Rivera Policy Institute, 2006), 9–12.

31 Rachel Unruh, "Investing in Success: Educational Supports for Illinois Community College Students" (Chicago: Women Employed Institute, 2006).

32 The Illinois Community College Board has partnered with the Illinois State Board of Education and the Illinois Board of Higher Education in a number of statewide transition initiatives to further align and share expectations across P–20 education and into the workforce. The Illinois Articulation Initiative (IAI) seeks to improve the transfer process among all sectors of Illinois higher education. Currently there are 95 schools recognized by IAI currently as full-participation schools including two- and four-year institutions (public and private). The Illinois transfer rate for cohorts of community-college-entering students has been increasing since fiscal year 2004, reaching 38.4 percent in 2007, and is well above the national average. The number of student transfers from Illinois community colleges to other institutions increased by 22 percent between 2003 and 2007. In 2007, out of 23,783 community college student transfers, 44 percent went into a public university, 36 percent into independent universities, and 20 percent into other community colleges.

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40 Sylvia Ann Hewlett, Carolyn Buck Luce, and Lisa J. Servon, “Stopping the Exodus of Women in Science,” Harvard Business Review (June 2008).

Encouraging Latinos in technology careers contributes to economic growth and gives Illinois a competitive edge in new global markets where bilingual communication and cultural competence are key advantages.

Creating Opportunity.
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