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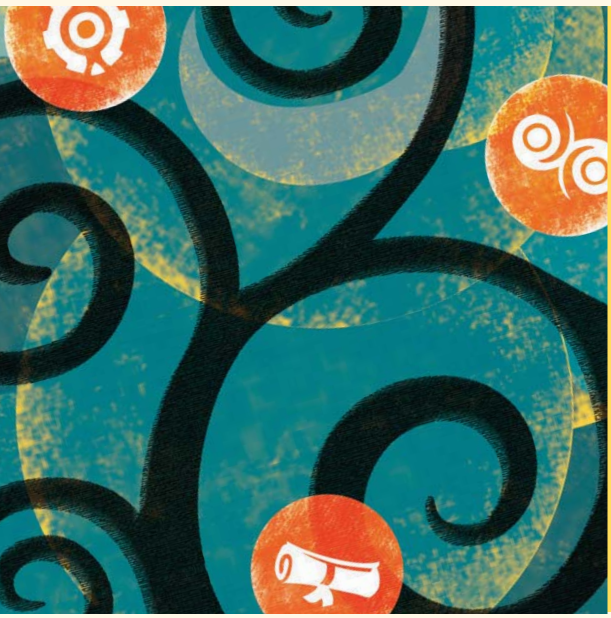

Benchmarking the Success of Latina and Latino Students in STEM to Achieve National Graduation Goals

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Center for Urban Education

Benchmarking the Success of Latina and Latino Students in STEM to Achieve National Graduation Goals

This report identifies 25 Hispanic Serving Institutions (HSIs) in five states as potential exemplars of effective practices for increasing the number of Latina and Latino bachelor's degree holders in science, technology, engineering, and mathematics (STEM). This report is the first in a series based on a study funded by the National Science Foundation: *Pathways to STEM Bachelor's and Graduate Degrees for Hispanic Students and the Role of Hispanic Serving Institutions.* It shows that at the majority of these exemplary HSI colleges and universities, Latino students are represented nearly proportionally in STEM majors and among STEM graduates. Where Latinos are underrepresented in STEM, the gap does not typically exceed five percentage points. We recommend that other institutions analyze the involvement of Latina and Latino students in STEM fields on their campuses and set performance benchmarks for equitable inclusion.

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Background on Increasing Latina and Latino[1] STEM Participation and Degree Completion

A number of recent reports document the consequences of the growing demand for a highly educated and skilled workforce and the decreasing proportion of college-educated adults, particularly in states experiencing rapid growth in the Latino population. They tell a consistent story: The United States is falling behind other countries—including Canada, Japan, Korea, Norway, Ireland, Belgium, Denmark, Spain, and France—in the proportion of 25- to 34-year-olds with college degrees.

In his first address to Congress, President Barack Obama brought the nation's attention to this issue when he called on all Americans to complete at least one year of postsecondary education to help this country regain its premier status by having the most highly educated populace in the world. To regain first place by 2025, the nation must award three million postsecondary degrees and certificates per year, which is a third more than the two million degrees currently awarded annually.

Latinos are now the fastest growing demographic group throughout the country and projected to make up 29% of the entire U.S. population by 2050, as compared with 15% in 2007 (Passel & Cohn, 2008).

Our USC colleague Dowell Myers describes demographic change and the economy as being "on a collision course" that can be avoided "only by elevating the educational level of the newest generation entering the workforce" (2007, p.199). That newest generation is predominantly Latina and Latino.

For example, in California, which is a national trendsetter in terms of demographic change, the share of Latinos in the workforce is expected to grow to 40% by 2020 and to become the majority by 2040. Latinos are now the fastest growing demographic group throughout the country and projected to make up 29% of the entire U.S. population by 2050, as compared with 15% in 2007 (Passel & Cohn, 2008).

However, in California and other states where Latinos are rapidly shedding their "minority" status, existent educational disparities signal the emergence of a dangerously polarized society with a shrinking professional class and a growing population of Latinos in the unskilled labor force (Myers, 2007). A number of recent studies have found that large numbers of students who are eligible to enroll in college are not doing so, thereby forming a pool of "undeveloped talent."

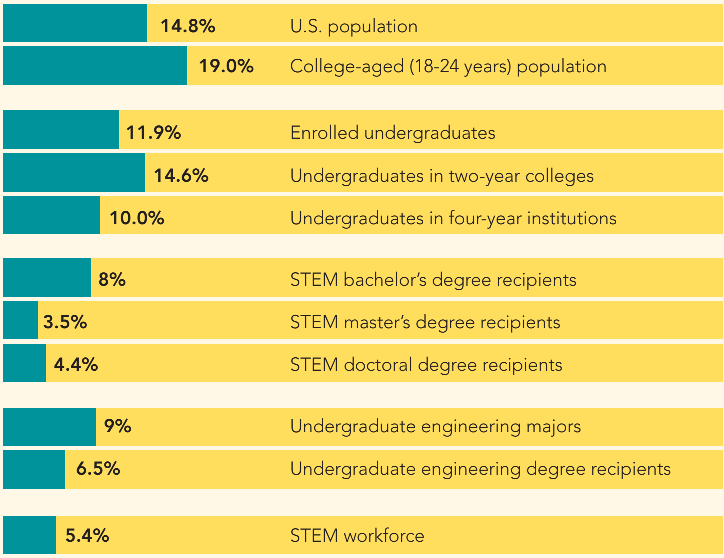
Although the number of Latinos participating in some form of higher education has more than doubled over the past two decades, Latino participation in STEM has not experienced the same gains.

This undeveloped talent of Latinos in science, technology, engineering, and mathematics (STEM) fields[2] is particularly onerous. Although the number of Latinos participating in some form of higher education has more than doubled over the past two decades, Latino participation in STEM has not experienced the same gains. As Figure 1 illustrates, Latinos constituted 19% of the college-aged (18- to 24-year-old) population in 2006. In that year, however, only 8% of bachelor's degrees, 3.5% of master's degrees, and 4.4% of doctorates in STEM fields were awarded to Latinos. This is not due to a lack of interest. Among Latinos who enroll in four-year institutions, 36% indicate an intention to major in a STEM field. Latinos also enter STEM majors at rates similar to whites and African Americans. More should be done to build on this interest in order to increase the number of Latino STEM undergraduate and graduate degree holders.

1 The terms Latino and Hispanic are used interchangeably in this report to refer to persons who trace their origin or descent to Mexico, Puerto Rico, Cuba, Spanish speaking Central and South America countries, and other Spanish cultures (Fry, 2008). Rather than always subsuming the feminine form, at times the text states "Latina and Latino" and at others "Latino" is used, inclusive of female students.

2 STEM fields include computer science/mathematics; biological, agricultural, and environmental science; physical science; social and behavioral science; engineering; science and engineering-related fields. The analyses reported here exclude the social and behavioral sciences.

Figure 1. Latinos in Higher Education and in STEM Fields of Study, 2006



Sources: National Center of Education Statistics. (2005). Digest of education statistics, 2005. Washington, DC.

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The Important Role of Hispanic Serving Institutions (HSIs)

According to the federal government's definition, Hispanic Serving Institutions (HSIs) are those at which Latino students constitute 25% or more of the full-time equivalent enrollment. Only about 8% of all postsecondary institutions are HSIs, but about half of all Latino college students are enrolled in these institutions. It is not surprising, then, that HSIs are responsible for awarding nearly 40% of all bachelor's degrees conferred to Latinos.

Obviously, HSIs are positioned to provide important pathways to STEM fields by virtue of the large numbers of Latinos they serve. The crucial role they will play in increasing STEM achievement among Latinos was recently recognized by the U.S. Congress. In March 2009, the America COMPETES Act authorized the National Science Foundation to establish programs to support HSIs in improving STEM education. These grant-funded programs are expected to improve the quality of undergraduate STEM education at HSIs and increase the graduation and retention rates of students pursuing associate's or baccalaureate degrees in these fields.

To help meet the national goal of increasing postsecondary degree completion and also to address the necessity of expanding Latino achievement in STEM fields, the Center for Urban Education (CUE) has been studying education and educators in these fields at HSIs. Our first step was to identify potential exemplars of effective practice in Latino STEM education. Using multiple regression analysis of federal data, we examined variation in the proportion of Latinos receiving undergraduate degrees in STEM fields at these institutions. Taking into account such factors as institutional type, enrollment, and number of STEM majors, we identified four-year HSI colleges and universities that are producing more than their expected share of Latino STEM baccalaureates (see Technical Appendix for details).

To help meet the national goal of increasing post-secondary degree completion and also to address the necessity of expanding Latino achievement in STEM fields, the Center for Urban Education (CUE) has been studying education and educators in these fields at HSIs.

We then focused on six states with large Latino populations (Arizona, California, Florida, New Mexico, New York, and Texas) and considered the 25 institutions listed in Table 1 as potential exemplars of effective practice in providing STEM education for Latinos.

Table 1. Twenty-five Potential Exemplars for Latino STEM Education

Institution	# STEM Degrees Awarded to Hispanics	% Hispanic* Enrollment	% Hispanic STEM Enrollment	% STEM Degrees Awarded to Hispanics
Florida International University, FL	613	60.40%	62.80%	57.80%
University of Texas at El Paso, TX	404	74.10%	72.90%	70.40%
University of Texas at San Antonio, TX	357	42.60%	45.50%	43.80%
University of Texas Pan American, TX	319	87.50%	82.60%	78.40%
New Mexico State University Main, NM	217	44.00%	43.90%	32.50%
University of New Mexico Main, NM	217	34.90%	32.00%	33.00%
Texas A&M University Kingsville, TX	185	64.10%	60.60%	52.50%
University of Texas at Brownsville, TX	131	89.10%	88.60%	85.40%
St. Mary's University, TX	118	69.30%	72.60%	69.80%
Texas A&M International University, TX	90	90.40%	92.30%	96.80%
Nova Southeastern University, FL	79	27.40%	22.10%	25.60%
Barry University, FL	78	30.80%	31.50%	35.90%
California State University Bakersfield, CA	73	37.40%	33.80%	30.90%
Our Lady of the Lake University, San Antonio, TX	68	77.10%	80.10%	78.20%
University of the Incarnate Word, TX	43	59.30%	62.60%	55.80%
Saint Edward's University TX	40	31.40%	37.70%	29.00%
University of La Verne, CA	38	35.80%	39.10%	36.90%
University of Texas Permian Basin, TX	32	37.50%	42.60%	32.70%
Mount St. Mary's College, CA	23	49.00%	43.50%	46.90%
Saint Thomas University, FL	19	45.60%	46.20%	47.50%
College of Mount Saint Vincent, NY	17	30.40%	30.40%	42.50%
Western New Mexico University, NM	11	44.90%	36.00%	36.70%
Southwestern Adventist University, TX	10	26.00%	19.60% 3	1.30%
La Sierra University, CA	10	37.40%	20.80%	22.70%
College of the Southwest, NM	5	36.90%	47.60%	50.00%

Data source: Institutional Postsecondary Education Data System (IPEDS)
*Note: In reporting results in these tables, we use the term Hispanic to be consistent with the IPEDS data.

Equity Indicators of Latina and Latino STEM Participation

The 25 institutions in Table 1, selected through regression analysis as potential exemplars of effective practice in Latino STEM education, include large public research universities and small private colleges. They graduated as many as 613 or as few as five Latinos in STEM fields in 2005-06 (column 2). As HSIs, all these institutions had Latino enrollments that were above 25%, but there was considerable variation among them. At most, the share of Latino students was greater than one-third of the total enrollment, and on a few campuses, it approached 90% (column 3). The share of Latino STEM enrollments (column 4) and of Latinos being awarded STEM degrees (column 5) at these campuses was just as varied, ranging from around 20% to over 90%.

To benchmark the current state of equity in Latino STEM degrees among this group of HSI exemplars, we made two comparisons. As shown in Table 2, we first compared the proportion of Latinos enrolled in STEM fields with the overall Latino enrollment at these institutions. This difference provides an equity indicator of Latina and Latino *STEM participation* (column 4 of Table 2). Throughout the nation, even campuses with great racial-ethnic diversity do not have equitable participation of underserved racial-ethnic groups in high-status programs and areas of study such as STEM. In contrast, 12 of the 25 colleges and universities in these tables reported that the share of Latinos in STEM fields exceeded the Latino share of their enrollment. At others where the difference was negative, the gap ranged from -.10% to -16.6%, with most campuses having a difference of approximately five percentage points or less.

Throughout the nation, even campuses with great racial-ethnic diversity do not have equitable participation of underserved racial-ethnic groups in high-status programs and areas of study such as STEM.

Table 2. Benchmark Equity Indicators of Latino Participation in STEM Fields

Institution	% Hispanic Enrollment	% Hispanic STEM Enrollment	Equity Indicator 1 STEM Participation (% Hispanic STEM Enrollment – % Hispanic Enrollment)
College of the Southwest, NM	36.90%	47.60%	10.70%
Saint Edward's University, TX	31.40%	37.70%	6.30%
University of Texas Permian Basin, TX	37.50%	42.60%	5.10%
St. Mary's University, TX	69.30%	72.60%	3.30%
University of the Incarnate Word, TX	59.30%	62.60%	3.30%
University of La Verne, CA	35.80%	39.10%	3.30%
Our Lady of the Lake University San Antonio, TX	77.10%	80.10%	3.00%
University of Texas at San Antonio, TX	42.60%	45.50%	2.90%
Florida International University, FL	60.40%	62.80%	2.40%
Texas A&M International University, TX	90.40%	92.30%	1.90%
Barry University, FL	30.80%	31.50%	0.70%
Saint Thomas University, FL	45.60%	46.20%	0.60%
College of Mount Saint Vincent, NY	30.40%	30.40%	0.00%
New Mexico State University Main, NM	44.00%	43.90%	-0.10%
University of Texas at Brownsville, TX	89.10%	88.60%	-0.50%
University of Texas at El Paso, TX	74.10%	72.90%	-1.20%
University of New Mexico Main, NM	34.90%	32.00%	-2.90%
Texas A&M University Kingsville, TX	64.10%	60.60%	-3.50%
California State University Bakersfield, CA	37.40%	33.80%	-3.60%
University of Texas Pan American, TX	87.50%	82.60%	-4.90%
Nova Southeastern University, FL	27.40%	22.10%	-5.30%
Mount St. Mary's College, CA	49.00%	43.50%	-5.50%
Southwestern Adventist University, TX	26.00%	19.60%	-6.40%
Western New Mexico University, NM	44.90%	36.00%	-8.90%
La Sierra University, CA	37.40%	20.80%	-16.60%

Data source: Source: Institutional Postsecondary Education Data System (IPEDS)

Second, as shown in Table 3, we compared the proportion of *STEM degrees awarded to* Latinos (column 3) with the proportion of Latinos *enrolled* in STEM fields (column 2). This difference provides an equity indicator of *STEM degrees awarded.* Strictly as a result of demographic and enrollment growth, institutions may find that the numbers of Latinos in STEM fields are growing. However, increasing the number of Latinos with STEM degrees will also require increasing the institution's capacity to graduate Latino STEM majors. In this exemplary group, the share of Latinos being awarded STEM degrees exceeded the Latino share of STEM enrollment, demonstrating a high degree of success in supporting Latino degree completion. At the others where the difference was negative, the gap ranged from -1.70% to -11.4%, with most of these campuses again having a difference of approximately five percentage points or less.

Table 3. Benchmark Equity Indicators of STEM Degrees Awarded to Latinos

Institution	% Hispanic STEM Enrollment	% STEM Degrees Awarded to Hispanics	Equity Indicator 2 STEM Degrees Awarded (% Hispanic STEM Degrees – % Hispanic STEM Enrollment)
College of Mount Saint Vincent, NY	30.40%	42.50%	12.10%
Southwestern Adventist University, TX	19.60%	31.30%	11.70%
Texas A&M International University, TX	92.30%	96.80%	4.50%
Barry University, FL	31.50% 3	5.90%	4.40%
Nova Southeastern University, FL	22.10%	25.60%	3.50%
Mount St. Mary's College, CA	43.50%	46.90%	3.40%
College of the Southwest, NM	47.60%	50.00%	2.40%
La Sierra University, CA	20.80%	22.70%	1.90%
Saint Thomas University, FL	46.20%	47.50%	1.30%
University of New Mexico Main, NM	32.00%	33.00%	1.00%
Western New Mexico University, NM	36.00%	36.70%	0.70%
University of Texas at San Antonio, TX	45.50%	43.80%	-1.70%
Our Lady of the Lake University San Antonio, TX	80.10%	78.20%	-1.90%
University of La Verne, CA	39.10%	36.90%	-2.20%
University of Texas at El Paso, TX	72.90%	70.40%	-2.50%
St. Mary's University, TX	72.60%	69.80%	-2.80%
California State University Bakersfield, CA	33.80%	30.90%	-2.90%
University of Texas at Brownsville, TX	88.60%	85.40%	-3.20%
University of Texas Pan American, TX	82.60%	78.40%	-4.20%
Florida International University, FL	62.80%	57.80%	-5.00%
University of the Incarnate Word, TX	62.60%	55.80%	-6.80%
Texas A&M University Kingsville, TX	60.60%	52.50%	-8.10%
Saint Edward's University. TX	37.70%	29.00%	-8.70%
University of Texas Permian Basin, TX	42.60%	32.70%	-9.90%
New Mexico State University Main, NM	43.90%	32.50%	-11.40%

Data source: Institutional Postsecondary Education Data System (IPEDS)

Setting Performance Benchmarks for Equity in STEM

These equity indicators can be used to set **performance benchmarks** for increasing the proportion of Latino STEM majors and graduates. Institutions can compare their own data to those in our exemplar group in order to gain a sense of the improvements that are possible. To do this, one calculates the two equity indicators as shown to determine whether the values fall in the range of these exemplary HSIs. Where Latino students are underrepresented in STEM enrollments and STEM degrees awarded, improvement goals can be set by establishing benchmarks against the performance of a peer institution in, such as those identified in this report.

It must be noted that these highly aggregated numbers tell only part of the story. Within programs and fields of study as well as by gender, we would also expect to see considerable variation in Latino STEM participation and degree completion at different institutions. It is possible to examine these variations by field and by disaggregated categories of ethnicity and gender when analyzing the far more detailed data available for individual campuses.

Although HSIs award a disproportionate number of STEM degrees to Latinos, the majority of STEM bachelor's degrees in the United States are awarded by non-HSIs. Because of this, across-the-board improvements are needed at both HSIs and non-HSIs. In 2005-06, for example, 20,238 STEM bachelor's degrees were awarded to Latinos by U.S. institutions; those awarded in Puerto Rico[3] are not included in this figure. Approximately 30% (5,959) of these degrees were awarded by HSIs. Even if all the other HSIs in the six states we studied (i.e., those not listed among the exemplars in this report) had produced Latino STEM bachelor's degree graduates in 2005-06 as successfully as did those in Table 1, only 525 additional Latino students would have earned STEM bachelor's degrees. This would constitute a considerable improvement for those particular institutions (approximately a 27% increase in Latino STEM degree production), but still only a tentative step toward achieving the national degree completion goals set by President Obama, the new American Graduation Initiative, and the America COMPETES Act.

The time has come for colleges of all sizes and levels of selectivity to engage in process benchmarking. This will involve determining what it takes to adopt new programs, whether it be learning communities, peer tutoring, supplemental instruction, or any of a number of strategies that have attracted attention in recent years.

In order to achieve these ambitious goals, colleges and universities will need to find new approaches to help students succeed. The institutions featured in this report can serve as a point of departure for organizing a peer group for **diagnostic benchmarking**. This process involves comparing the practices of one's own institution to the exemplary practices of others in order to see how innovation and improvement may be possible, given the available resources.

However, with new federal funds being channeled to HSIs, the time has come for colleges of all sizes and levels of selectivity to engage in **process benchmarking**. This will involve determining what it takes to adopt new programs, learning communities, peer tutoring, supplemental instruction, or any of a number of strategies that have attracted attention in recent years. By examining how other institutions have tried and tested new ideas, HSIs will be more likely to succeed in bringing about positive changes on their own campuses, whether they be in the curriculum, pedagogy, student services, or all of the above.

There is a great deal of interest in discovering, disseminating, and measuring the effectiveness of exemplary practices. Much can be learned from institutions that have been leading the way in expanding Latino participation in STEM. We look to them as potential repositories of what are often called "best practices," but which we prefer to call exemplary practices. It is important to bear in mind that what is best on one campus may not work at all on another because of differences in resources, personnel, and institutional culture. For this reason, the usefulness of identifying and disseminating effective practices is greatly increased by utilizing three benchmarking strategies.

The first strategy is **performance benchmarking**, in which colleges set and monitor performance goals using graduation rates and other indicators of educational achievement, disaggregated by race and ethnicity. The second strategy is diagnostic or **"best practices" benchmarking**, in which colleges compare practices on their campus with programs and policies in use at other colleges that have proven exemplary in terms of effectiveness, innovation, or orientation to ensuring the equitable participation of underserved racial-ethnic minority groups. The third strategy is **process benchmarking**, in which faculty and administrators make guided site visits to exemplary colleges in order to learn about the steps they would need to take in order to adopt the observed exemplary practices on their own campuses.

While performance benchmarking and "best practices" benchmarking are integral parts of popular reform strategies today, the crucial step of process benchmarking is often overlooked. College decision-makers need to know how their administrative structures, faculty roles, and student support services must be changed in order to incorporate new programs and policies successfully.

To obtain specialized data analysis tools for all three forms of benchmarking, contact the Center for Urban Education at http://cue.usc.edu.

3 Degrees earned in Puerto Rico were excluded because Hispanics in Puerto Rico and in the continental U.S. experience a different cultural and higher education context.

Considering the ongoing demographic shifts throughout this country and the undeveloped talent pool of Latinos within our borders, the challenge of developing and maintaining a highly skilled workforce is inextricably linked to that of achieving diversity among STEM degree holders. Stated simply, to accomplish our national higher education goals, we must increase the numbers of Latinos earning STEM credentials at all levels—associate's, bachelor's, and master's degrees, doctorates, and vocational and professional certifications.

Recommendations for Practitioners and Policy Makers

Legislation underway to implement President Obama's proposed American Graduation Initiative places important emphasis on two types of benchmarking. Most significantly, performance benchmarking is expected, as it appears that institutions will be required to set numerical improvement goals using baseline data disaggregated by race and ethnicity. The starting point for diagnostic benchmarking is also in place, as institutions are urged to adopt "best practices," particularly those that rigorous research has found to be effective. However, as Table 4 shows, there are presently no incentives to study the change process in order to determine what will make effective practices work on any given campus.

Table 4. Three Types of Benchmarking—All Essential for Improving Degree Production

Type of Benchmarking	What Is Involved	American Graduation Initiative
Performance	Goal setting for productivity and equity	Valuably emphasizes goal setting using disaggregated racial-ethnic data
Diagnostic	Assessing practices on one's own campus against established standards of effective practice	Directs attention to and expects adoption of effective practices
Process	Closely investigating the nuts and bolts of what makes effective practices work at peer colleges.	Lacks incentives to ensure effective practices are adopted in ways that will work.

We recommend that HSIs respond to the call for increased degree production—in STEM and other fields—by collaborating to identify and investigate the conditions under which effective practices are most likely to achieve the desired results on their respective campuses. Evidence is needed not only on "best practices" but also on how faculty members, counselors and administrators must become "best practitioners" to bring about the envisioned improvements.

To address this shortcoming, we recommend that HSIs respond to the call for increased degree production—in STEM and other fields—by collaborating to identify and investigate the conditions under which effective practices are most likely to achieve the desired results on their respective campuses. This involves gaining a thorough understanding of the resources and institutional supports that are required. Evidence is needed not only on "best practices" but also on how faculty members, counselors and administrators become "best practitioners" to bring about the envisioned improvements. Forthcoming reports in this series include an example of how a college used benchmarking tools developed by the Center for Urban Education to bring about student-centered improvements. A subsequent report will present findings from interviews with nearly 90 administrators, faculty members, and counselors illustrating exemplary practices and policies at HSIs. As policy makers implement the American Graduation Initiative and higher education leaders respond to the call to action, we strongly recommend that they incorporate process benchmarking as an essential ingredient for effective reform.

Technical Appendix

Identifying HSI Exemplars in Latina and Latino STEM Bachelor's Degree Production

To identify Hispanic Serving Institutions as potential exemplars of Latina and Latino STEM participation and degree completion, the following analysis was conducted using institutional data from the 2005-06 academic year in the Integrated Postsecondary Education Data System (IPEDS). The analysis included all four-year institutions with complete data in six Hispanic-intensive states: Arizona, California, Florida, New Mexico, New York, and Texas (n=260). (The model was not limited to HSIs).

To identify Hispanic Serving Institutions in these states that perform above statistical expectations in the area of Latino STEM bachelor's degree attainment, a linear model was estimated. The model was based on our assumption that the percentage of STEM degrees awarded to Latinos by each institution was a function of the following independent variables:

- Percentage of Hispanic undergraduate enrollment
- Total number of undergraduate STEM majors (i.e., size of STEM degree programs)
- Total undergraduate enrollment (i.e., size)
- Selectivity
- Control

The model was as follows: $y = \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots + C + e$ where y is the % of STEM degrees earned by Hispanic students at an institution, x_n are the aforementioned independent variables, β are the beta coefficients, C is a constant, and e are the residual terms.

Although additional variables could have been included, the model using only the aforementioned independent variables explained 72.02% of the variance between the institutions in the sample. Including additional covariates reduced the model's parsimony without substantively increasing the model's explanatory power. Diagnostics indicated that multicollinearity was not a problem. Graphing revealed the relationship to be linear, as did post-hoc statistical tests of the residuals.

The table below presents the results from the regression analysis. Because the institutions in the sample are clustered within states, robust standard errors are reported.

Institutions that performed above the values predicted by the model were identified on the basis of the residual term e as potential exemplars. These colleges and universities awarded a higher share of STEM bachelor's degree to Latino students than was expected, given their values on the control variables in the model.

Appendix Table 1. Linear Model of Hispanic Student Share (%) of STEM Bachelor's Degrees for Four-year Institutions in AZ, CA, FL, NM, NY, and TX

Independent Variable	B_coeff	Robust S.E.
Percent Hispanic Enrollment	0.7750	0.2036**
Total # STEM Enrollment	-0.0003	0.0002
Total Enrollment	0.00007	0.00009
Selectivity		
Selective	1.8512	0.7458*
Very Selective	1.6868	0.9066
Highly Selective	1.5459	1.1204
Non-selective (reference)		
Control		
Private	-1.2878	2.4061
Public (reference)		

Notes: **p < 0.01, *p < 0.05
Source: Analysis of Integrated Postsecondary Education Data System (IPEDS), 2005-06.

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