AC 2012-4626: AT A CROSSROADS: EMERGING HISPANIC-SERVING INSTITUTIONS AND ABET ACCREDITATION - AN EXPLORATORY STUDY

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At a Crossroads - Emerging Hispanic-Serving Institutions and ABET Accreditation: An Exploratory Study

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Abstract

The intent of this paper is to introduce an exploratory study of the academic success of Latino students in engineering at Hispanic-Serving Institutions (HSIs) and Emerging Hispanic-Serving Institutions that are accredited by the Accreditation Board for Engineering and Technology (ABET) - the recognized accreditation body in the U.S. for applied science, computing, engineering, and technology. This paper provides an overview of various demographics of the HSIs and Emerging HSIs in relevance to ABET engineering accreditation. Data on institutional characteristics, faculty, student enrollment, persistence and graduation will is presented. This paper is a prelude to a proposed study investigating the broader implications on the value of "Hispanic-Serving" and "Hispanic-Enrolling" in the context of engineering education for Hispanic students. The goal of this study is to eventually provide summative recommendations regarding the role of ABET-accredited HSIs and ABET-accredited Emerging HSIs in preparing a technically-talented STEM workforce.

Introduction

The powering of today's New Economy requires individuals to posses the 21st Century knowledge, skills and competencies that are needed to fully participate in the STEM Enterprise. At the core of this New Economy is technology, an artifact that must increasingly be leveraged to maximize earning potential and learning experiences. According to the U.S. Department of Commerce (Langdon, McKittrick, Beede, Knah, & Doms, 2011)[1], in 2010, 7.6 million people or 1 in 18 workers held STEM jobs. Over the past 10 years, STEM jobs grew three times faster then non-STEM jobs. Between 2008 and 2018, STEM jobs are projected to grow by 17 percent compared to 9.8 percent growth for non-STEM jobs. The concern for the U.S. is being able to supply a well-educated technical workforce.

It is estimated that by 2016, four out of every 10 new jobs will require some advanced education or training (Dohm & Shniper, 2007)[2]. In fact, fifteen of the 30 fastest-growing fields will require a minimum of a bachelor's degree (Bureau of Labor Statistics, 2007)[3]. However, the participation of underrepresented groups in this STEM Enterprise, fails to keep pace with their representative population growth. In fact, among Latinos, they only constitute 8.7 percent of the engineering workforce (U.S. Bureau of Labor Statistics, 2007)[4].

In 2009, President Obama, set a national goal that by 2020, America would once again have the highest proportion of college graduates in the world. This meant raising the population proportion of college graduates with a two-year or four-year degree, from 41 percent to 60 percent (U.S. Department of Education, 2010)[5]. The translation to real numbers means that the U.S. needs to produce an additional 13.4 million associate's and bachelor's degrees holders by 2020, to reach at least 51 percent (Santiago & Callan, 2010)[6]. For Latinos, degree attainment needs to increase by 3.3 million to an annual total of 5.5 million and would represent almost 25 percent of all additional degrees earned. (Santiago & Callan, 2010)[7].

Yet, for the United States to retain its global leadership in science and technology, then over the next decade it must not only just produce more college graduates, the country must produce 1 million more STEM professionals over its current rate. That is, the U.S. must increase its productions of STEM professionals by an additional 34 percent, each year, for the next ten years (President's Council of Advisors on Science and Technology, 2012) [8].

The national capacity to innovate requires broader participation of under-represented communities, which make up an increasingly large portion of the national population. In fact, the 2010 U.S. Census indicated that Hispanics constituted 16.4 percent of the U.S. population. (Humes, Jones & Ramirez, 2011) [9]. Since Latinos are making up a greater percent of the U.S. population, it is also a national imperative to increase the college completion rate of Latinos, especially within science, technology, engineering and math (STEM). The gaps in degree attainment for Latinos must be eliminated to help ensure that the President's goals are met and this country remains a leader in global technological innovation.

Literature Review

In 2000-01, 385,842 STEM degrees were awarded by Title IV institutions. In 2008-09, 433,742 STEM degrees were awarded, an increase of 12.4 percent. However, the percent of STEM degrees awarded in 2000-01 was 12.9 percent, and in 2008-09 decreased to 10.7 percent. (U.S. Department of Education, 2011) [10]. According to College Board data based on the college completion rates of the 1995–96 Beginning Postsecondary Students (BPS:96/01), in total 33 percent of males and 15 percent of females entered a STEM field. However, only 8 percent and 4 percent of the total males and females, respectively, completed a STEM bachelor's degree. Among Hispanics, 22 percent entered a STEM field; 4 percent completed a STEM bachelor's degree (Baum, Ma, & Payea, 2010) [11].

As many efforts have been aimed at addressing the issue of underrepresentation in STEM in the last two decades, progress has been much slower than expected. In fact, the percentage of 24-year-old Hispanics, having earned a first degree in natural sciences or engineering is only 2.2 percent. This is the lowest among all underrepresented minority groups including African Americans, Native Americans and Alaska Natives (National Research Council, 2011) [12].

A study by the National Action Council for Minorities in Engineering (NACME) (2008) [13], indicates that the progress made in increasing underrepresented minority enrollment in engineering is more than offset by the lower retention rate of underrepresented minorities (39 percent), when compared to that of all engineering students (63 percent). Research indicates that over time, engineering students become academically disengaged. Data from the HERI Institute, analyzed by the author, indicates that from 1975-2010 there has been a persistent downward trend among all students, regardless of ethnicity, who intend to major in engineering. The President's Council of Advisors on Science and Technology (2012) [14] acknowledges increased departure from STEM during the first two years of college due to perceived unwelcoming environments, lack of math preparation, and disengaging introductory engineering courses. As students near their fourth year in college, they become dismayed not by the engineering content, but rather by an engineering education structure that emphasizes technical problem solving in a

closed environment and lacks preparation for professional practice and competencies (Sheppard, Pellegrino, & Olds, 2008) [15]. Therein, only a third of engineering students actually persist into an engineering career; 60 percent do not limit themselves to becoming an engineer, but move on to other careers (Ohland, et al, 2008[16]; Seymour & Hewitt, 1997[17]).

A challenge in keeping underserved and underrepresented in STEM, particular engineering is to change the traditional view and behavior of higher education with regards to this discipline. In Straczynski (2011[18]), 37 percent of STEM department chairs rated their institution with a "C" or below in regards the successful recruitment and retention of underserved students. Most of the department chairs (84 percent) recognized that recruiting and retaining women and minority students was a prominent challenge. The department chairs indicated several significant barriers for underserved students, including a lack of educational preparation (32 percent), a lack of role models (17 percent), and introductory "weeding out" courses (46 percent). Yet while there is a concern, 57 percent felt no need to change the climate and culture of the department. In fact, 83 percent said that faculty members do indeed advise students away from STEM degrees; 59 percent reported that this discouragement occurs "frequently" or "occasionally." These data are alarming, especially when underrepresented populations do aspire to major in STEM disciplines (Cole & Espinoza, 2008[19]; Higher Education Research Institute, 2010[20]).

ABET

The engineering bachelor's degree remains as the sole undergraduate, accredited professional degree. ABET is the organization that accredits this professional degree offering at the programmatic level for applied science, computing, engineering, and engineering technology (ABET, 2012[21]). ABET was founded in 1932 by seven engineering societies to accredit and regulate the engineering professional (ABET, 2012[22]). It accredited its first engineering program in 1936, its first engineering technology program in 1946, and its first computer science program in 1985. Today, ABET is a global accrediting body, having accredited over 3,100 programs at more than 600 colleges and universities in 23 countries.

In 1997, ABET adopted Engineering Criteria 2000 (EC2000), to evaluate student achievement against 11 criteria that is based on learned content (outputs) rather than what is taught (inputs) (Lattuca, Terenzini & Volkwein, 2006[23]). The intent was to improve preparation of engineering students to enter the profession. The study by Lattuca, Terenzini & Volkwein (2006) [24] indicate that the EC2000 was having a positive impact on engineering education, including the teaching of basic science, math, and engineering science skills. However, the study did reveal that post-EC2000 students were experiencing "somewhat chillier diversity climate" than pre-EC2000 students. Notwithstanding, according to ABET (2005) [25], "accreditation criteria do not address the cultivation of a diverse learning environment, and its Board of Directors heard very clearly from its constituents that it should not mandate diversity goals as part of its standards." (p13) As such, the imperative to broaden engineering education from its current state of highly quantitative focus to also include a more democratic and socially responsive curriculum presents a daunting challenge; a challenge that might serve to attract and retain underserved students at any college or university.

Hispanic-Serving and Emerging Hispanic-Serving Institutions

The Higher Education Act, specifically Title V, as amended, Section 501-518 defined a Hispanic-Serving Institution (HSI) as an institution that enrolls at least 25 percent Hispanic undergraduate FTE and at least 50 percent of the enrolled degree-seeking students receive need-based aid or a substantial percentage of the students are receiving Federal Pell Grants (Title V Program Statute, n.d.)[26]. In 1992, HSIs were formerly recognized in Title III of the Higher Education Reauthorization Act with no funding; funding was not appropriated until the 1996 reauthorization (Espino & Cheslock, 2008)[27]. The 2008 Reauthorization of the Higher Education Act under Public Law 110-315, titled Higher Education Opportunity Act, removed the HSI defining component which requires that 50 percent of the degree-seeking students must be low-income receiving financial aid.

HSIs are unlike the other types of Minority-Serving Institutions (MSIs), which include Historically Black Colleges and Universities (HBCUs) and Tribal Colleges and Universities (TCUs). Collectively, MSIs graduate the majority of students of color in the United States and Puerto Rico (Gasman, Baez, & Turner, 2008)[28]. Historically Black Colleges and Universities (numbering 104) and Tribal Colleges and Universities (numbering 30 mostly on reservations) were specifically established with a "historical, institutional mission" to serve blacks and Native Americans, respectively (Benitez & DeAro, 2004)[29]. According to Margarita Benitez, who helped spearhead the development of Title V for HSIs, HSIs are defined by student enrollment numbers, do not have a historical mission, and do not have an overt institutional commitment to Hispanic students (Benitez & DeAro, 2004)[30]. In fact, Contreras, Malcom, and Bensimon (2008)[31] posit that HSIs have a "manufactured identity" since HSIs can come and go based on their enrollment numbers and how they are defined by Title V, the U.S. Department of Education Office of Civil Rights (OCR) and the Hispanic Association of Colleges and Universities (HACU).

The Hispanic Association of Colleges and Universities (HACU) maintains a membership list of Hispanic-Serving Institutions. Member institutions who meet the criteria defined by HACU pay an annual membership fee based on the total headcount enrollment of the institution. The criteria for an HSI member institution is stated as "a non-profit, accredited college, university or system where total Hispanic enrollment constitutes a minimum of 25% of the total enrollment." (Hispanic Association of Colleges and Universities, 2007)[32]. Institutions who do not meet the HSI definition of HACU can become associate, partner or international members of HACU so long as they enroll either 10 – 24 percent Latino/a undergraduate enrollment or 1,000 Latino/a headcounts (Contreras, Malcom, & Bensimon, 2008)[33]. In sum, HACU has 205 HSI member institutions, 120 associate member institutions, 69 partner institutions, and 45 international institutions (Hispanic Association of Colleges and Universities, 2007)[34].

Even though HSIs enroll at least 25 percent of Latino/a students they still fail to graduate equitable numbers of students, especially in STEM fields. As noted by Contreras, Malcom, and Bensimon (2008)[35], in regard to math and engineering majors, Whites exceeded Latino/as in the number of degree attainments. Furthermore, the authors indicate that of the STEM disciplines, Latino/as were more represented in the biological sciences, yet still failed to achieve degree attainment equity compared to whites (Contreras, Malcom, & Bensimon, 2008)[36]. This is a

detriment given the amount of federal funding that is afforded to HSIs in expectation of supporting Latino/a student success.

Until recently, there were few studies about Hispanic-Serving Institutions (HSIs) and Hispanic students. The homogeneity of HSIs has been argued to be an advantage and disadvantage for Latino/a students (Contreras, Malcom, & Bensimon, 2008) [37]. Scholars have argued that HSIs have a perception of being more inclusive and affirming of minority student success (Hurtado, Milem, Clayton-Pederson, & Allen, 1998) [38]. According to Solorzano (1995) [39], role model theory suggests that HSIs provide a significant critical mass of Latino/a faculty and peers present would lead to greater numbers of Latino/a students aspiring to high-status occupations. However, some scholars indicate that it is not institutional type so much as the context of social and psychological support created by the institution (Pasceralla & Terenzini, 1991) [40]. On one hand the critical mass of Latinos/a enables them to transition and persist in higher education far greater than their Latino/a peers attending PWIs (Solorzano, 1995) [41]. On the other hand, because HSIs do not represent the complete ethnic demographics of society, they potentially have the effect of providing an over-sheltered education. In other words, the education Latinos/as receive in the absence of diversity at an HSI, may make the transition into the dominant white-male STEM workforce may be a culture shock.

Methodology

According to the 2010 U.S. Census, the ten states with the largest Hispanic population were California, Texas, Florida, New York, Illinois, Arizona, New Jersey, Colorado, New Mexico and Georgia. These states accounted for 78.3 percent of all Latinos in the U.S. *(*Ennis, Ríos-Vargas, & Albert, 2011) [42]. Data derived from the Integrated Postsecondary Education Data System (IPEDS), indicate that these ten states accounted for 42 percent of the 252,091 science, technology, engineering and math (STEM) bachelor degrees conferred in 2010. Of the 16,356 STEM bachelor degrees awarded to Hispanics, these ten states accounted for 75 percent of those degrees. (Table 1).

Table 1. 2010 Census and STEM Bachelor's Degrees, 2009-2010, by State

State	2010 Census Hispanic Population	Percent Hispanic	STEM Bachelor's Degrees Awarded, 2009-2010		
			Total	Hispanics	Percent Hispanic
U.S.	50,477,594	16.3	252,091	16,356	6.5
Arizona	1,895,149	29.6	5,875	586	10.0
California	14,013,719	37.6	27,718	3,275	11.8
Colorado	1,038,687	20.7	5,035	330	6.6
Florida	4,223,806	22.5	11,097	1,968	17.7
Georgia	853,689	8.8	6,746	259	3.8
Illinois	2,027,578	15.8	10,451	600	5.7
New Jersey	1,555,144	17.7	5,550	561	10.1
New Mexico	953,403	46.3	1,207	432	35.8
New York	3,416,922	17.6	17,572	1,045	5.9
Texas	9,460,921	37.6	15,444	3,265	21.1

The Integrated Postsecondary Education Data System, the Accreditation Board for Engineering and Technology (ABET), and *Excelencia in Education* listings of Hispanic-Serving Institutions and Emerging Hispanic-Serving Institutions were used to identify the final set of institutions for this project.

First, IPEDS fall 2009 public data was queried to identify those institutions that were 4-year, degree-granting, and public, private for-profit or private not-for-profit. A list of 2,999 institutions was returned. Next, this list of institutions was queried for their Hispanic FTE. Of interest was to identify which institutions had at least a 25 percent Hispanic FTE. Approximates for full-time equivalency (FTE) for Hispanics was calculated using a formula that accounts for three part-time students are equivalent to one full-time student (FTE= FT + PT/3)). Full-time and part-time enrollments were used. Using the calculated FTE, 64 public, 88 private not-for-profit and 85 private for-profit 4-year institutions with at least a 25 percent Hispanic FTE were identified. Table 2 provides a summary count of these 237 institutions by state, which includes the institutions in Puerto Rico. Likewise, 45 public, 69 private not-for-profit and 63 private for-profit 4-year institutions with less than 24 percent Hispanic FTE were identified as Emerging Hispanic-Serving Institutions (Table 3). The focus of this study is the number of 4-year, public and 4-year private-not-for-profit Hispanic-Serving Institutions and Emerging Hispanic-Serving Institutions.

TABLE 2. Number of Hispanic-Serving Institutions by State

	Public, 4-year	**Private, not-for-profit 4-year**	**Private for-profit, 4-year**	**Total**
Arizona			10	10
California	16	12	30	58
Colorado	2	1	5	8
Florida	3	10	10	23
Georgia		1		1
Illinois	1	3	6	10
Indiana			1	1
Louisiana		2		2
Maryland		2		2
Nevada			1	1
New Jersey	1	3	2	6
New Mexico	7	2		9
New York	4	6	4	14
North Carolina			1	1
Oregon		1		1
Puerto Rico	14	33	7	54
Texas	16	10	6	32
Virginia		1	1	2
Washington		1		1
Wyoming			1	1

TOTAL	64	88	85	237
TOTAL w/o Puerto Rico	50	55	78	183

TABLE 3. Number of Emerging Hispanic-Serving Institutions by State

	Public, 4-year	**Private, not-for-profit 4-year**	**Private for-profit, 4-year**	**Total**
Arizona	2	1	6	9
California	8	23	12	43
Colorado			4	4
Connecticut	1		1	2
Florida	6	8	11	25
Illinois	1	3	3	7
Indiana	1	1		2
Kansas		1	2	3
Maryland			1	1
Massachusetts		5	2	7
Missouri		1		1
Nevada	3		2	5
New Jersey	5	4	1	10
New Mexico		1	2	3
New York	6	8	5	19
Oklahoma	1		1	2
Tennessee		1		1
Texas	10	12	7	29
Virginia			3	3
Washington	1			1
TOTAL	45	69	63	177

The Accreditation Board for Engineering and Technology (ABET) maintains a current listing of the U.S. institutions and institutional programs accredited by its four commissions[1]. These commissions include the Engineering Accreditation Commission (EAC), the Computing Accreditation Commission (CAC), the Technology Accreditation Commission (TAC) or the Applied Science Accreditation Commission (ASAC). To date, ABET has accredited a total of 390 four-year, degree-granting, public, private not-for-profit and private-for-profit higher education institutions by the Engineering Accreditation Commission. In addition, ABET has 271 institutions accredited by the Computing Accreditation Commission, 136 institutions accredited by the Technology Accreditation Commission, and 30 institutions accredited by the Applied Science Accreditation Commission.

The ABET-EAC institutions were mapped against the original universe of 2,999 IPEDS institutions to identify institutional characteristics and fall 2009 enrollments. The results identified 243 ABET-EAC institutions as 4-year public institutions and 142 ABET-EAC

[1] The ABET website was accessed on September 15, 2011, to download the list of 386 institutions.

institutions as private, not-for-profit institutions. Two ABET-EAC institutions were classified as private, for-profits[2].

Next, based on the enrollment data, a total of 26 unique HSIs and 36 unique eHSIs are accredited by at least one of the ABET commissions. Specifically, 21 of the ABET-EAC institutions were identified as HSIs. Thirty of the ABET-EAC institutions were identified as Emerging Hispanic-Serving Institutions (eHSIs)[3]. Of the 271 ABET-CAC institutions, 17 are HSIs and 19 are eHSIs. Of the ABET-TAC institutions, 6 are HSIs and 8 are eHSIs. Finally, of the 30 ABET-ASAC institutions, one is an HSI and 6 are eHSIs (Table 4).

Table 4. Number and Percent of ABET Institutions, ABET-HSIs and ABET-eHSIs by Accreditation Commission

ABET Commission	Number of ABET Institutions	Number (and Percent) of ABET Accredited HSIs	Number (and Percent) of ABET Accredited Emerging HSIs
EAC	390	21 (5.4)	30 (7.7)
CAC	271	17 (6.3)	19 (7.0)
TAC	136	6 (4.4)	8 (5.9)
ASAC	30	1 (3.3)	6 (20)

In 2009, these 19 institutions awarded 1035 engineering bachelor degrees to Hispanic students, accounting for 33 percent of the total engineering bachelor degrees awarded by these HSIs to Hispanics (Table 5).

Table 5. Engineering Bachelor Degrees

Institution	**State**	**Undergraduate FTE, Fall 2009**			**No. Engineering Bachelor's Degrees Awarded, 2009**		
		Total	**Hispanic**	**% Hispanic**	**Total**	**Hispanic**	**% Hispanic**
California State Polytechnic University-Pomona	CA	6712	2123	31.6	579	111	19.2
California State University-Fresno	CA	6114	2054	33.6	112	24	21.4
California State University-Fullerton	CA	10245	3205	31.3	101	19	18.8
California State University-Long Beach	CA	9774	2822	28.9	341	53	15.5
California State University-Los Angeles	CA	5335	2567	48.1	103	36	35
California State University-Northridge	CA	9858	3102	31.5	149	28	18.8
University of California-Riverside	CA	5664	1635	28.9	132	26	19.7
Colorado State University-Pueblo	CO	1603	404	25.2	7	-	-
Florida International University	FL	10576	6786	64.2	313	215	68.7

[2] Three of the institutions were not identifiable in the IPEDS Universe.
[3] The list of ABET-EAC HSIs and ABET-EAC eHSIs are presented in Appendix A.

New Mexico Institute of Mining and Technology	NM	440	118	26.8	85	21	24.7
New Mexico State University-Main Campus	NM	4897	2257	46.1	141	62	44
University of New Mexico-Main Campus	NM	7110	2552	35.9	163	45	27.6
CUNY City College	NY	4292	1387	32.3	228	42	18.4
Texas A & M University-Kingsville	TX	2094	1391	66.4	90	43	47.8
Texas State University-San Marcos	TX	8667	2106	24.3	27	9	33.3
The University of Texas at El Paso	TX	5734	4574	79.8	237	153	64.6
The University of Texas at San Antonio	TX	8335	3672	44.1	153	66	43.1
The University of Texas-Pan American	TX	5315	4747	89.3	90	72	80
St Mary's University*	TX	790	549	69.5	13	10	76.9

*Private Institution

Using the calculated FTE, institutions with at least 15 – 24 percent Hispanic FTE were identified as Emerging HSIs. 177 institutions were identified. Of these, 36 institutions are accredited by ABET. Of the 36 Emerging HSIs accredited by ABET, 30 have programs accredited by the Engineering Accreditation Commission (EAC) (Table 6).

Table 6. Emerging HSIs, Engineering Bachelor Degrees

Institution	**State**	**Undergraduate FTE, Fall 2009**			**No. Engineering Bachelor's Degrees Awarded, 2009**		
		Total	**Hispanic**	**% Hispanic**	**Total**	**Hispanic**	**% Hispanic**
Arizona State University	AZ	48554	7740.0	0.16	569	78	0.14
University of Arizona	AZ	27570	5095.0	0.18	384	55	0.14
California State University-East Bay	CA	10957	1741.7	0.16	13	3	0.23
California State University-Sacramento	CA	21081	3793.0	0.18	208	41	0.20
Loyola Marymount University*	CA	5659	1076.3	0.19	53	12	0.23
San Diego State University	CA	26190	5671.3	0.22	282	61	0.22
San Francisco State University	CA	22387	3922.7	0.18	97	9	0.09
San Jose State University	CA	22308	3892.7	0.17	402	52	0.13
University of California-Los Angeles	CA	27077	4019.7	0.15	476	32	0.07
University of California-Santa Barbara	CA	19791	4239.0	0.21	193	17	0.09
University of California-Santa Cruz	CA	15374	2724.7	0.18	41	5	0.12
University of San Diego*	CA	5083	748.7	0.15	45	6	0.13
Florida Atlantic University	FL	17504	3214.3	0.18	177	34	0.19
Florida Gulf Coast University	FL	7839	1180.3	0.15	20	2	0.10
Florida State University	FL	22216	3715.7	0.17	253	31	0.12

University of Miami*	FL	10294	2209.7	0.21	146	39	0.27
University of South Florida-Main Campus	FL	26738	3878.0	0.15	343	46	0.13
University of Illinois at Chicago	IL	15262	2799.7	0.18	309	36	0.12
Purdue University-Calumet Campus	IN	6451	1021.0	0.16	45	3	0.07
University of Nevada-Las Vegas	NV	19400	3111.0	0.16	115	22	0.19
New Jersey Institute of Technology	NJ	5133	1004.0	0.20	318	38	0.12
Rutgers University-Newark	NJ	6683	1292.3	0.19	-	-	-
CUNY College of Staten Island	NY	9875	1513.3	0.15	24	-	-
Texas A&M University at Galveston	TX	892	209.3	0.23	22	8	0.36
Texas Tech University	TX	22139	3224.0	0.15	463	34	0.07
The University of Texas at Arlington	TX	16098	3112.0	0.19	217	27	0.12
The University of Texas at Austin	TX	34199	6734.0	0.20	954	135	0.14
University of Houston	TX	23652	5474.0	0.23	192	40	0.21
University of Houston-Clear Lake	TX	3120	687.0	0.22	5	-	-
West Texas A&M University	TX	5328	1124.7	0.21	21	1	0.05

Enrollment data on the universe of 380 ABET-Engineering Accredited 4-year public and private, not-for-profit institutions is presented below. As a group, HSIs enroll a Hispanic FTE of 42 percent. In comparison, the thirty Emerging HSIs as a group, enroll a combined FTE of 18 percent. The 331 institutions, which are not classified as HSIs or Emerging HSIs, enroll a combined Hispanic FTE of 7 percent.

Of the total Hispanic Undergraduate FTE from all 380 institutions, HSIs enroll 13 percent of the FTE, and Emerging HSIs enroll an additional 24 percent of the FTE. Thus, 49 institutions enroll 37 percent, over one-third, of the total Hispanic Undergraduate FTE enrolled in 4-year public and private, not-for-profit ABET-Engineering accredited institutions (Table 7).

Table 7. FTE for HSIs, EHSIs, ABET-EAC-HSIs

Description	**Non-HSI and Non-Emerging HSI ABET-EAC**	**HSI ABET-EAC**	**Emerging HSI ABET-EAC**	**Total ABET-EAC**
Total 4-Year Public and Private-Not-For-Profit Institutions	331	19	30	380
Total Undergraduate FTE, Fall 2009	3,196,320	113,555	504,854	3,814,729
Total Hispanic Undergraduate FTE, Fall 2009	232,916	48,051	90,169	371,136
% Hispanic Undergraduate FTE, Fall 2009	7.3	42.3	17.9	9.7

Data on numbers of engineering bachelors degrees awarded in 2009 is presented in the table below (Table 8). In sum, as a group, the 19 HSIs award 34 percent of their engineering bachelor degrees to Hispanics. The 30 Emerging HSIs award 14 percent of their engineering degrees to

Hispanics. Comparatively, only 4 percent of engineering bachelor degrees are awarded to Hispanics among the group of 331 non-HSIs and non-Emerging HSIs.

Furthermore, 24 percent of the total engineering bachelor degrees awarded by the 380 ABET-engineering accredited institutions are awarded by Hispanic Serving Institutions. Emerging HSIs award an addition 20 percent.

Table 8. Bachelor Degrees for HSIs, EHSIs, ABET-EAC-HSIs

Description	Non-HSI and Non-Emerging HSI ABET-EAC	HSI ABET-EAC	Emerging HSI ABET-EAC	Total ABET-EAC
Total 4-Year Public and Private-Not-For-Profit Institutions	331	19	30	380
No. Engineering Bachelor Degrees Awarded, 2009	58,406	3,064	6,387	67,857
No. Engineering Bachelor Degrees Awarded to Hispanics, 2009	2,443	1,035	867	4,345
% Engineering Bachelor Degrees to Hispanics, 2009	4	34	14	6

Value of Hispanic-Serving on Engineering Education

This exploratory study intends to inform college faculty and administrators of the marked experiences that are both common and uncommon among Hispanic science and engineering undergraduates at Hispanic Serving Institutions. Based on a real awareness of these experiences, the institutional challenge is to (re)focus efforts to create and sustain an environment that is congruent to the student. These efforts represented as a menu of resources, must be made accessible both actively and passively, to empower students in successfully navigate their education enroute to graduation. In fact, as Bauer-Dantoin & Ritch (2005) indicate, higher education must move beyond the “add and stir” approach to increasing diversity in the design of science and engineering programs and practices.

Broad Implications of ABET-HSI Accreditation

Hispanic students who succeed in STEM recognize a master narrative that science and engineering is competitive, isolationist, and limited in social interaction (Cruz, 2010). These students have bought into the master narrative of science for the benefit of a global diversity. Science for the global environment has pushed race and ethnicity to the periphery, and subconsciously insists on the nature of science and engineering as colorblind. Most students do not describe their STEM college journey as a struggle. Some negotiate their cultural identity with the institutional culture and lived bi-culturally. Other students completely abandon their Hispanic identity and assimilate into the science and engineering culture. They acknowledge the difficulties of pursuing a science or engineering degree, regardless of their ethnicity, and view this as an opportunity absent of race/ethnicity rather than a barrier. Others were not critical conscious of being Hispanic in a predominately white male career or institution.

On one hand, Hispanic STEM students attending an HSI may not be fully aware of the classification (Cruz, 2010). However, they are conscious of the mass of Hispanic students on campus and indicate a concern of the potential lack of competitiveness at the institution, due to the saturation of Hispanic students on campus. They are conscious of the competitive nature of not only earning a STEM degree but obtaining a well=paying STEM career. Subsequently, Hispanic STEM students are reaching out to external opportunities to increase their technical and 21st century skills to compensate for the perceived lack in a competitive education at the HSI.

Acknowledging the structural confinements helps to redefine the strategies that need to be employed to ensure that Hispanic students succeed in the system. For example, if the cultural values of students are not understand or valued by existing teachers, then maybe we need to encourage more Hispanic STEM professionals to enter the teaching profession to teach with a respective understanding of their social status and funds of knowledge from which to develop a set of tools and resources for college success. Maybe we need to support programs that certify motivated retired Latino/a professional to come into the school and teach students math and science that relates the concepts to real world experience from a Latino/a perspective.

Hispanic-Serving Institutions (HSIs) and Emerging Hispanic-Serving Institutions play a pivotal role in the development and growth of communities and economies throughout the nation. As eligible Title V institutions, it is fundamental for HSIs and Emerging HSIs to meet the needs of its diverse student population. As shifting demographers point to an increasing Hispanic population, it is imperative that these institutions ramp up capabilities to support this growing community.

Conclusion

The challenge to increase the educational trends for Hispanics is an enormous task. But this task is enormous because of the changes that can only be made within the current and persistent educational system that oppresses, marginalizes, and fails to cultivate the educational experience of Hispanics. Whatever metaphor you choose - pipeline, pathway, river – to describe the education system, it has become so entrenched with a culture of dominant thought that values high social class and works to reproduce that class in the teaching mechanisms, curriculum, teacher demographics, funding and student investment.

Both higher education and the STEM discipline must critically engage STEM students in retention efforts that will be viewed as authentic, empowering, and meaningful. University policy, curriculum, advisement, retention and support services must demonstrate a real practice of student empowerment. The imperative insists for a rapid solution to clear the STEM educational pathway of non-sense barriers and focus on developing the 21st Century skills of a technically relented workforce.

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