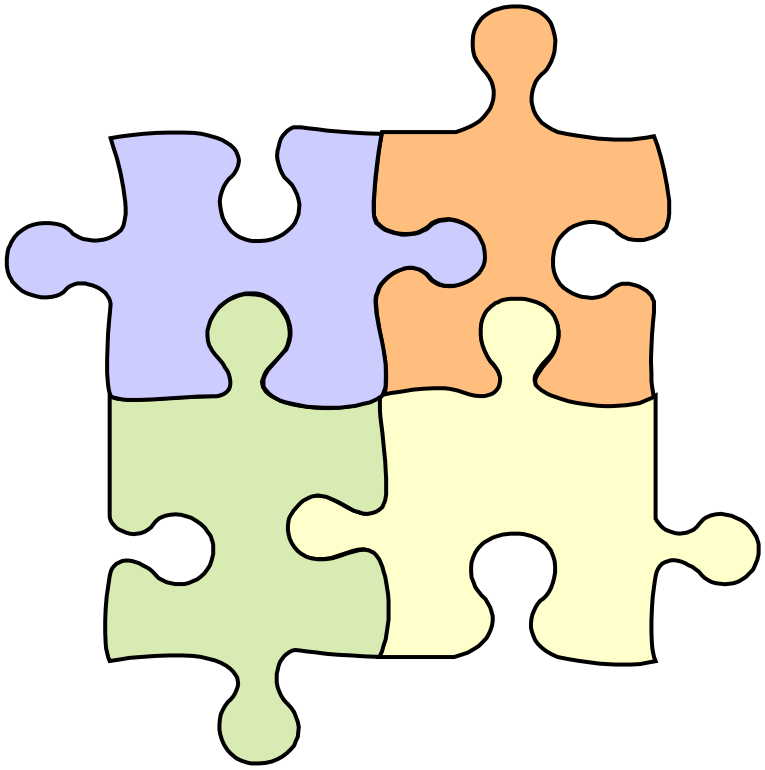
Making the Pieces Fit:
Exemplary Practices at the Baccalaureate Level at Selected Hispanic-Serving Institutions

A Research Project of the Role of Recruitment and Retention Practices and Institutional Culture in the Production of Future STEM Doctorates at Hispanic-Serving Institutions



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Important Note

This document has been prepared as a summary version of the research project's final report. Copies of the complete *Making the Pieces Fit* report may be obtained by contacting the author.

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Executive Summary

The one-year long study was conducted under the auspices of the American Association for Higher Education (AAHE), included in-kind contribution from NSF, and was partially funded by the Alfred P. Sloan Foundation. The goals of the study were to discover the role of recruitment programs, retention strategies, and institutional culture in the production of doctorates in Science, Technology, Engineering, and Mathematics (STEM) at selected Hispanic-Serving Institutions (HSIs), and to develop a model of research-based best practices.

Results from the current study showed that institutional mission was ultimately linked to admission criteria and selectivity. Also, when looking at recruitment strategies, those considered most effective included: recruiting to retain, having involved parents, attracting talented Hispanic students, and providing financial aid. In addition, the most successful retention strategies included freshmen year programs, course re-design, academic support programs, and intrusive intervention strategies designed to prevent academic crises. This study also highlighted the importance of research opportunities for undergraduates, and the benefits of mentors as role models and networking resources.

Findings from this research revealed that there are unique and culturally supportive environments and specific academic and affective strategies at these institutions that, when used in tandem, enhance Hispanic STEM students' abilities to pursue terminal degrees. The research-based best practices highlighted in this study can—and should—be replicated at other HSIs and at mainstream institutions with large Hispanic enrollment.

Definition of Terms

Following are the definitions of some specific terms used throughout this report:

Baccalaureate Origin Institution- the baccalaureate or undergraduate institution from which the STEM doctoral recipient earned a bachelor's degree.

Baccalaureate Origins Methodology- methodology that determines institutional productivity at the baccalaureate level. It was pioneered by Dr. Elizabeth Tidball, who used it to determine the productivity of women's institutions approximately 35 years ago.

Carnegie Classification- The Carnegie Foundation classification of institutions of higher education institutions includes all degree-granting and accredited colleges and universities in the United States. This study uses the 2000 edition of classification categories. For a definition of the 2000 Edition Category definitions refer to: www.carnegiefoundation/classification/CIHE2000/defNotes/Definitions.htm.

Hispanic- Hispanic is a term used to describe persons whose ethnic/cultural origins are from a Spanish-speaking country. This term encompasses the major sub-groups of Mexican Americans, Puerto Ricans, Cuban Americans, and Other Hispanics. The Survey of Earned Doctorates has included Cuban Americans and all other Hispanics except Mexican Americans and Puerto Ricans in the single category, Other Hispanics. For purposes of this study, Cuban Americans are included as Other Hispanics.

Hispanic Serving Institutions (HSIs)- These are accredited institutions of higher education, regardless of Carnegie classification, that have a Hispanic student enrollment of 25% or more, and fit the accepted U.S. Department of Education definition.

Institutional Profiles- For the purposes of this study, the term 'institutional profile' is used to describe the results of the resulting data on recruitment and retention strategies, and on institutional culture, obtained via qualitative methods.

Productivity Index- Used in the baccalaureate origins methodology, productivity index is a ranking of institutions according to their productivity ratios.

Science, Technology, Engineering and Mathematics (STEM)- As used by the National Science Foundation, STEM fields include engineering, mathematics, and computer sciences, as well as the physical

and life sciences. For Quintana-Baker (2000) and this study, all STEM fields were combined into three broad scientific categories: life sciences, engineering, and physical sciences.

Survey of Earned Doctorates- An annual survey of all individuals, in all disciplines, who earn a research doctorate from a U.S. institution. The survey is conducted annually on behalf of the National Science Foundation and four other government agencies. The data is then stored in the Doctorate Records File.

Background

Study Goals:

1] To document and describe the recruitment programs, retention strategies, and institutional cultural factors that may have contributed to the successful production of future Hispanic doctorates in science and engineering; and

2] To build a research-based Model of Exemplary Practices.

Note: "science and engineering" here includes mathematics and technology.

This research study concerns the current exemplary practices at the baccalaureate level in selected Hispanic-Serving Institutions (HSIs) regarding the production of future doctorates in STEM (science, technology, engineering, and mathematics).

A previous study, *The Baccalaureate Origins of Latino Doctorates in Science and Engineering* (Quintana-Baker, 2000), identified the institutions in this study to be among the top twenty most *productive* institutions in the nation, regardless of size or the absolute number of degrees granted. The study used the database contained in the Annual Survey of Earned Doctorates-Doctorate Records File, and replicated the baccalaureate origins methodology pioneered by Tidball (1973), a methodology employed by numerous researchers thereafter (Braziel 1983; Hill 1994; Leggon and Pearson 1996; Sharpe and Fuller 1995; Solorzano 1994, 1995; and Wolf-Wendel, 1998).

The annual Survey of Earned Doctorates is a census of every individual who earns a research doctoral degree (Ph.D., Sc.D., Ed.D.) from a U.S. institution, the results of which are published yearly by the National Academy Press. All of the completed surveys become part of the Doctorate Records File (DRF), a comprehensive data bank on doctorate recipients since 1920.

By definition, the baccalaureate origins methodology looks at how productive an institution is, regardless of size and of the absolute number of degrees granted.

For the study by Quintana-Baker (2000), only records of individuals who earned a doctorate in life sciences, engineering, mathematics, or physical sciences between 1983 and 1997, and who self identified as Hispanic U.S. citizens obtaining a baccalaureate degree from an institution in the U.S. (including Puerto Rico) were included. A total of 3,315 individual records were disaggregated according to three Hispanic subgroups: Mexican American, Puerto Rican, and Other Hispanic (which included all who had not self identified as either Mexican American or Puerto Rican). Using descriptive statistics, the top 20 baccalaureate-granting institutions for all Hispanic doctorates combined were ranked according to productivity, and separate rankings were developed by gender and subgroup.

Table 1. Institutions in the Study [by Carnegie 2000 Classification]

Doctoral/ Research Extensive	New Mexico State University [Las Cruces] University of Miami [Coral Gables] University of New Mexico [Albuquerque]
Doctoral/ Research Intensive	University of Texas at El Paso [El Paso]
Master's Colleges & Universities I	New Mexico Highlands University [Las Vegas] Our Lady of the Lake University [San Antonio] St. Mary's University [San Antonio] St. Peter's College [Jersey City] Sul Ross University [Alpine] University of the Incarnate Word [San Antonio] University of Texas-Pan American [Edinburg]

Productivity Ratio Formula

X divided by Y times 100 = Productivity Ratio

To compute the productivity ratios for each category, a frequency count revealed that the interval during which the majority of these individuals obtained their baccalaureates was 1984 to 1993. The yearly average number of bachelor's degrees granted per institution during that interval was used as the denominator (Y). The numerator (X) was the total number of future Hispanic Ph.D.s produced by the particular institution between 1993 and 1997. Therefore, the number of future doctorates per institution (X) was divided by the yearly average number of bachelor's degrees granted by that institution during the specified time period (Y) times 100 (per 100 students). The computation revealed the *productivity ratio* of future doctorates per institution and resulted in the ranking of individual institutions for each category as described above.

Table 2. Top Twenty Baccalaureate-Granting Institutions in the Nation (1984–93), **Ranked by Productivity** of Future STEM Doctorates (1993–97)

All Latinos Combined

Rank and institution	State	**Prod. Ratio**	Future Ph.D.s	Mean STEM Bachelor's	Carnegie Class. +	Control
1. University of Texas-El Paso*	TX	**11.5**	44	381	D/I	Pub
2. University of Incarnate Word*	TX	**10.0**	4	40	MC/UI	Priv
3. New Mexico Highlands Univers.*	NM	**9.7**	4	41	MC/UI	Pub
4. California Institute of Technology	CA	**9.7**	19	196	D/E	Priv
5. University of Miami*	FL	**7.2**	47	656	D/E	Priv
6. New Mexico Inst. Mining & Tech.	NM	**5.9**	8	135	D/I	Pub
7. Massachusetts Inst. of Technology	MA	**5.3**	55	1,037	D/E	Priv
8. St. Mary's University*	TX	**5.1**	9	177	MC/UI	Priv
9. University of New Mexico*	NM	**5.0**	37	736	D/E	Pub
10. New Mexico State University*	NM	**4.9**	32	666	D/E	Pub
11. Sul Ross State University*	TX	**4.3**	3	70	MC/UI	Pub
12. St. Peter's College*	NJ	**4.0**	5	127	MC/UI	Priv
13. Swarthmore College	PA	**3.8**	8	216	B/LA	Priv
14. Reed College	OR	**3.8**	5	133	B/LA	Priv
15. Harvard University	MA	**3.3**	34	1,058	D/E	Priv
16. Loyola Marymount University	CA	**3.3**	9	269	MC/UI	Priv
17. Princeton University	NJ	**3.3**	23	692	D/E	Priv
18. Rice University	TX	**3.3**	14	423	D/E	Priv
19. University of California-Riverside	CA	**3.3**	16	473	D/E	Pub
20. University of Tex–Pan American*	TX	**3.0**	5	164	MC/UI	Pub

*Hispanic Serving Institution. +2000 Carnegie Classifications

Sample Group of Institutions

Table 2, above, lists the twenty most productive baccalaureate-granting institutions for all Hispanics combined *according to their productivity rankings*. Ten of the twenty institutions in this group are Hispanic Serving Institutions (HSIs). Table 3, below, ranks the top ten most productive institutions for all Hispanics combined and according to gender. Sixty percent of the schools in Table 3 are also HSIs.

The sample group of eleven institutions in the present study includes all those HSIs that ranked among the top twenty baccalaureate institutions for all Hispanics combined (Table 2), and among the top ten each when disaggregated by gender (Table 3).

Table 3. Top Ten Baccalaureate-Granting Institutions in the Nation (1984–93), **Ranked by Productivity** of Future STEM Doctorates (1993–97), **by Gender**

Rank and institution	State	Prod. Index	Future Ph.D.s	Mean STEM Bachelor's	Carnegie Class. +	Control
MEN						
1. University of Texas–El Paso*	TX	8.3	32	381	D/I	Pub
2. New Mexico Highlands Univ.*	NM	7.3	3	41	MC/UI	Pub
3. California Institute of Technology	CA	7.1	14	196	D/E	Priv
4. New Mexico Inst. Mining & Tech.	NM	5.9	8	135	D/I	Pub
5. University of Miami*	FL	4.9	32	656	D/E	Priv
6. Massachusetts Inst. of Technology	MA	4.4	46	1,037	D/E	Priv
7. New Mexico State University*	NM	4.1	27	666	D/E	Pub
8. St. Mary's University*	TX	3.4	6	177	MC/UI	Priv
9. University of New Mexico*	NM	3.1	23	736	D/E	Pub
10. Reed College	OR	3.0	4	133	B/LA	Priv
WOMEN						
1. University of the Incarnate Word*	TX	10.0	4	40	MC/UI	Priv
2. University of Texas–El Paso*	TX	3.1	12	381	D/I	Pub
3. California Institute of Technology	CA	2.6	5	196	D/E	Priv
4. Harvey Mudd College	CA	2.5	3	119	B/LA	Priv
5. Bryn Mawr College	PA	2.5	4	162	B/LA	Priv
6. St. Peter's College*	NJ	2.4	3	127	MC/UI	Priv
7. New Mexico Highlands Univ.*	NM	2.4	1	41	MC/UI	Pub
8. University of Miami*	FL	2.3	15	656	D/E	Priv
9. Our Lady of the Lake University*	TX	2.1	1	48	MC/UI	Priv
10. Swarthmore College	PA	1.9	4	216	B/LA	Priv

* Hispanic Serving Institution. + 2000 Carnegie Classification

Approach

Each institution in the sample was contacted to request participation in the present study and to secure endorsement at the highest levels. All eleven institutions agreed to participate. Indeed, every institution extended itself to insure that the exchange was of the highest quality. Site visit arrangements were made for each institution and 140 individuals, including presidents, vice presidents, provosts, deans, faculty, administrators, staff, and students were interviewed by phone or in person during the study. Each interviewee signed an informed consent form, and each individual was guaranteed anonymity should his/her remarks be quoted in this document.

All interviews were audio taped and transcribed verbatim. The interview data were coded and categorized according to three themes: recruitment programs, retention strategies, and institutional culture factors. The verbatim transcriptions of the interviews have provided ample material for detailed description for each institution. Data were triangulated when additional information was gleaned from review of written institutional documents and web site content.

Table 4. Top Baccalaureate-Granting **HSIs** (1984–93), **Ranked by Productivity** of Future STEM Doctorates (1993–97), **All Latinos Combined**

Rank and institution	State	**Prod. Ratio**	Future Ph.D.s	Mean STEM Bachelor's	Carnegie class.	Control
1. University of Texas-El Paso	TX	**11.5**	44	381	D/I	Pub
2. University of Incarnate Word	TX	**10.0**	4	40	MC/UI	Priv
3. New Mexico Highlands Univ.	NM	**9.7**	4	41	MC/UI	Pub
4. University of Miami	FL	**7.2**	47	656	D/E	Priv
5. St. Mary's University	TX	**5.1**	9	177	MC/UI	Priv
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7. New Mexico State University	NM	**4.9**	32	666	D/E	Pub
8. Sul Ross State University	TX	**4.3**	3	70	MC/UI	Pub
9. St. Peter's College	NJ	**4.0**	5	127	MC/UI	Priv
10. Univ. of Texas-Pan American	TX	**3.0**	5	164	MC/UI	Pub
11. Our Lady of the Lake University	TX	**2.1**	1	48	MC/UI	Priv

Table 5. **Absolute Number** of STEM Ph.D.s (1993-97) Earned by Alumnae from 1984-1993, by Gender and Broad Field of Science

Institution [by productivity rank]	Life Sciences			Engineering			Physical Sciences			Tot. Men	Tot. Wo.	All Total
	M	W	ALL	M	W	ALL	M	W	ALL			
U T-El Paso	8	9	17	16	3	19	8		8	32	12	44
Univ. Incarnate Word		4	4								4	4
NM Highlands Univ.							3	1	4	3	1	4
University of Miami	9	6	15	12	4	16	11	5	16	32	15	47
St. Mary's University	2	3	5	1		1	3		3	6	3	9
Univ. New Mexico	4	9	13	12	2	14	7	3	10	23	14	37
NM State University	13	3	16	9	2	11	5		5	27	5	32
Sul Ross State Univ.							2	1	3	2	1	3
St. Peter's College	1	1	2				1	2	3	2	3	5
U T-Pan American	2	2	4		1	1				2	3	5
Our Lady Lake Univ.		1	1								1	1

During the interviews, each participant was asked open-ended questions regarding recruitment and retention strategies at his or her institution. The specific content of the answers depended on the institutional function of the interviewee. The last question asked of each interviewee was always the same: *"In your opinion, what are the factors that contribute to this institution's high productivity ratio? In other words, why is [name of institution] successful in producing future Hispanic Ph.D.s in science, technology, engineering, and mathematics (STEM)?"*

The process of triangulation among all three sources of primary data (interviews, written documents, and web-site content) yielded a deductive process that evolved into the institutional profiles. Each profile features the history and mission of the institution, demographic data about that institution, academic and financial information, data gleaned from interviews regarding recruitment and retention strategies, and a final section on institutional culture.

Summary of Research

The purpose of this study was two-fold. First, to document and describe the sample institutions' recruitment programs, retention strategies, and institutional cultural factors that may have contributed to the successful production of future Hispanic doctorates in STEM at the sampled institutions; and second, to assemble a set of Exemplary Practices based on the study's research findings.

Table 6. Recruitment and Retention Strategies [per interviewees]

Institutional Practices	**NMSU**	**UM**	**UNM**	**UTEP**	**NMHU**	**OLLU**	**St. Marv's**	**St. Peter's**	**Sul Ross**	**UIW**	**UTPA**
Outreach to High Schools	x	x	x	+	x				x		+
Summer Bridge Programs-H.S.			*	x					x		
Community College Bridge Programs or Articulation Agreements	x	x	x	x	x	x			x		x
Freshman Orientation	x	x		x	x		x		x		x
Freshman Seminar	x	x		x	x		*				
Cohort System	x	*		x							
Early Warning Intervention		*		x	x		x	x		x	
Undergraduate Research Opportunities-In School	x	x	x	x	x	x	+		x	+	x
Mentoring Program: Formal/Informal	x	x	x	x	x	x	x	x	x	x	x
Internships/Co-op Opportunities	x	x	x	x			x				x
Small Class Groups [1st & 2nd yrs]				*		x	x	x	x	x	
Academic Assistance and Counseling Programs	x	x	x	x	x	x	x	x	x	x	x
Learning Communities			x	x			x				
Supplemental Instruction	x	x		x			x				x
High Emphasis on Aca. Advising		*		x		x	x	x			*

* Engineering only + Sciences only

Table 6 summarizes those programmatic strategies that are common to the sampled institutions. Common recruitment and retention strategies among these institutions include: reaching out to middle and high schools in their communities through summer bridge programs, campus visits, college/high school students interaction, and teacher training; executing articulation agreements with appropriate two-year institutions to facilitate student transfer; instituting freshman year programs such as cohort systems, freshman orientation, and freshman seminars; expanding opportunities for undergraduate research on and

off campus; practicing intrusive intervention techniques such as an early warning system, tutoring, and supplemental instruction; recognizing the importance of good advising; and creating an infrastructure where smaller classes are possible and mentoring is facilitated.

Table 7. Institutional Culture Characteristics [per interviewees] *

Institutional Characteristics	NMSU	UM	UNM	UTEP	NMHU	OLLU	St. Mary's	St. Peter's	Sul Ross	UIW	UTPA
Available Role Models in Community		x		x						x	
Caring Faculty	x	x		x	x	x	x	x	x	x	x
Close Faculty/Student Interaction through Research Opportunities	x	x	x	x	x	x	x		x		x
Critical Mass/Large Hisp. Enrollmnt	x	x	x	x	x	x					
Education Valued in Community		x		x				x			x
Faculty Role: Priority on Teaching Rather than Research						x	x	x	x	x	x
Funding Leading to Special Programs/Financial Aid	x	x	x			x					x
Institutional Mission	x			x	x	x		x		x	
Location		x							x		
Mentoring (formal &/or informal)	x		x	x	x	x	x	x	x		x
Nurturing Environment		x		x	x	x	x	x	x	x	x
Sense of Belonging/Community for Students	x					x	x	x		x	
Size of School		x			x	x	x	x	x	x	
Small Classes		x			x	x	x	x	x	x	
School Does NOT Use Teaching Assistants					x	x	x	x	x	x	
Support/Commitment from the Top	x			x			x				x
Academic Reputation		x					x				

* Summary of Cultural Characteristics Responsible for Success of Future STEM Doctorate Production, as mentioned by interviewees at each Institution.

Table 7 illustrates the cultural characteristics shared by the institutions in the study. These include: a system that recognizes the value of teaching and rewards good teaching appropriately and publicly; a cadre of faculty, staff, and administrators who believe in the importance of service learning, and in creating a nurturing and supportive (family like) environment for students; a supportive administration that encourages special program efforts through funding and insures that the institutional mission is carried out; and an organization that has adapted its programs and efforts to the context in which it functions.

Summary of Exemplary Practices

It is the overlapping of appropriate institutional practices with specific discipline-based efforts that help bring success.

Selected programs and practices from the research-based institutional profiles of eleven Hispanic Serving Institutions are used as the building blocks to assemble a set of exemplary practices for student success at the baccalaureate level. A good portion of what is highlighted here pertains to the whole institution and not just to STEM areas. Indeed, findings from this study indicate that it is the overlapping and interlocking of institutionalized practices with specific discipline-based efforts that make these organizations successful.

It is not possible for this study to quantitatively confirm that these practices are precisely the reason for the success of these institutions, however, consensus among experts indicates that they are important components in their efforts. Expectations resulting from this study are that replication of these findings, in whole or in part, may lead to an increase in the number of future doctorates in STEM fields at Hispanic-Serving Institutions, other Minority-Serving Institutions (MSIs), and at majority institutions where there is a substantial Hispanic and other minority enrollment.

There are numerous commonalities among the efforts of these institutions to provide students with the tools and an environment that promote baccalaureate completion and subsequent pursuit of post-graduate education in these disciplines. Some of the efforts are university-wide while others are discipline-specific; some are operational at several of the schools while others are unique and innovative to one. The recruitment strategies and retention programs at these schools have been affected and influenced by the institutional mission and culture, and by the unique social and demographic context in which each school functions.

The participating institutions exhibit a variety of characteristics regarding institutional control, selectivity, size, location, Carnegie classification, and financial resources. The eleven sites include public

and private institutions ranging from a large urban public research university to several small private liberal arts universities. All the institutions in this study have one common characteristic—they are all focused in fulfilling their missions and providing the best educational goods and services possible within the realm of their capabilities.

Institutional Mission

The mission of each of the participating institutions is closely connected to institutional control (private or public) and both elements—mission and control—directly influence the admissions criteria and selectivity of each institution. There are five private and six public institutions in the study.

Recruitment

Because of cultural and demographic issues, Hispanics generally prefer to attend college near their home. Therefore, the most important factor to influence the recruitment process at the schools in this study is their location in heavily Hispanic populated areas, where Hispanics represent a ready and available pool of prospective students. However, although a large Hispanic enrollment is practically guaranteed for these HSIs, they do have to make special efforts to attract the highly talented and gifted Hispanic student, who, because of diversity initiatives at highly selective institutions, may have a myriad of school choices nationwide.

The process of college recruitment is complex and expensive, requiring coordinated efforts in a variety of fronts in order to achieve the goal of enrolling the students with the best institutional fit and highest probability of graduation. Recruiting for retention protects the income generated from tuition, and minimizes the expenses connected with replacing those lost through attrition. The more targeted the recruitment effort is, the higher the chances that the student who arrives as a freshman will graduate.

Other important facets of recruitment are parental involvement, providing adequate financial aid, and coordinating outreach activities to promote the institution and college attendance in general to the community. Since approximately 13% of the doctorate recipients in this study (14% nationally, Hill 1996) began their postsecondary education at a community college, it is very important for baccalaureate HSIs to facilitate transfer from two-year institutions.

Retention

Keeping students on track to baccalaureate degree completion is a major challenge facing many universities. Retention rates for Hispanics and other underrepresented minorities may be adversely affected by many factors, including poor pre-college academic preparation, low family income, first generation college status, commuter versus resident status, inability to develop a sense of belonging, poor social adjustment, heavy outside work demands, and a lack of heuristic knowledge. Therefore, it is necessary that institutions construct strong support infrastructures for retaining at-risk students.

Numerous retention programs are in place at the HSIs in this study, included are a variety of freshman year programs, course redesign, academic support, intrusive intervention, supplemental instruction, advising and mentoring, and targeted strategies for creating 'community' among students. Research opportunities for STEM undergraduates are available at each school, albeit governed by the type, size, and wealth of the institution.

Institutional Culture

Culture is the lens through which an institution's values are interpreted. Institutional culture reflects the collective experiences, ideas and patterns of thinking, basic assumptions, and values of an organization. These are represented through such elements as the mission statement, leadership, policies, practices, services, ceremonies, and programs. Universities must seek ways to make the impersonal and competitive culture of the academic world more congenial and suitable for all students. First generation college students, many of which are underrepresented minorities, are especially needy of attending institutions with receptive cultural environments.

Based on data from 140 interviews, of which 27% were faculty members, 29% were administrators, 40% were staff, and 4% were students, five major cultural elements emerged: the importance of a dedicated faculty, the merits of service learning, the benefits of mentoring, the sense of community as crucial to persistence, and that all institutional efforts need, and are validated by, support from the top.

Conclusion

Findings from this study confirm that there unique and culturally supportive environments, and specific academic and affective strategies that, when used in tandem, enhance STEM students' ability to pursue terminal degrees. In addition, results indicate that Hispanic students benefit from attending institutions that:

The Key:

A culturally supportive environment along with specific academic and affective strategies at institutional and departmental levels.

- Understand that it is the relationship, coordination, and juxtaposition of institutional and discipline-based programs and strategies that enhance future production of Hispanic STEM doctorates;
- Understand the importance of creating an institutional environment where those of different cultures can function—indeed, succeed;
- Understand the cultural values imbedded in the Hispanic culture, such as the importance of education and the importance of family, and address those appropriately.
- Understand the importance of supporting and encouraging university personnel (faculty, administrators, staff) whose vision and energy converts them into catalysts for improved change;
- Understand the importance of pursuing funding to create and operate special academic and heuristic programs, then to institutionalize those that work; and
- Understand the importance, in light of the projected national demographics, of insuring that every individual who is part of our U.S. human capital is valued and no one's talent is underutilized or wasted.

References

Braziel, W.F. 1983. "Baccalaureate College Origins of Black Doctorate Recipients." *The Journal of Negro Education* 52(2):102-9.

Carnegie Foundation for the Advancement of Teaching. 2000. *The Carnegie Classification of Institutions of Higher Education, 2000 Edition*. Available at: http://www.carnegiefoundation.org/Classification/index.htm.

Hill, Susan T. 1994. "African-American Recipients of the Doctorate Degree from United States Universities." Paper presented at the Association for the Study of Afro-American Life and History Conference, Atlanta.

_____. 1996. *Undergraduate Origins of Recent (1991-1995) Science and Engineering Doctorate Recipients*. National Science Foundation, Arlington, VA.

Leggon, Cheryl B., and Willie Pearson, Jr. 1996. "The Baccalaureate Origins of African American Female Ph.D. Scientists." Winston-Salem, NC: Department of Sociology, Wake Forest University, Unpublished.

Quintana-Baker, Maricel. 2000. *The Baccalaureate Origins of Latino Doctorates in Science and Engineering.* Doctoral Dissertation, American University, Washington, DC. Unpublished.

Sharpe, Norean R., and Carol H. Fuller. 1995. "Baccalaureate Origins of Women Physical Science Doctorates: Relationship to Institutional Gender and Science Discipline." *Journal of Women and Minorities in Science* 2:1-15.

Solorzano, Daniel. 1994. "The Baccalaureate Origins of Chicana and Chicano Doctorates in the Physical, Life, and Engineering Sciences: 1980-1990." *Journal of Women and Minorities in Science* 1(4).

_____. 1995. "The Doctorate Production and Baccalaureate Origins of African Americans in the Sciences and Engineering." *The Journal of Negro Education* 64(1):15-32.

Tidball, M.E. 1973. "Perspective on Academic Women and Affirmative Action." *Educational Record* 54:130-35.

Wolf-Wendel, Lisa. E. 1998. "Models of Excellence: The Baccalaureate Origins of Successful European American Women, African American Women, and Latinas." *Journal of Higher Education* 69(2): 141-80.

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Critically important conclusions have emerged from the results of this study—conclusions that are specifically directed to institutional and faculty policies and practices…

…and these are:

there are unique and culturally supportive environments and specific and affective strategies at these institutions, that, when used in tandem, enhance STEM students' ability to pursue terminal degrees.

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