



**Research  
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Minority  
Graduate  
Education  
(MGE)  
Volume 1  
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October 1999**

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## From the Editors

Each issue of *Making Strides* features a profile on an institution that received an NSF Minority Graduate Education (MGE) award. This issue we are pleased to include an article written by Gary S. May, the Principal Investigator for FACES (Facilitating Academic Careers in Engineering and Science), the MGE program at Georgia Tech.

Dr. Robert Ibarra, a professor at the University of Wisconsin-Madison, contributes a research piece on [Multicontextuality: A New Perspective on Minority Underrepresentation in SEM Academic Fields](#). To further elaborate on the issues covered in Dr. Ibarra's paper, Dr. Shirley Malcom shares her comments and ["unpacks" these themes](#). Also included in this issue is the [Executive Summary](#) from an NSF-funded report, researched and written by Drs. Beatriz Clewell and Vincent Tinto.

You will also find data excerpted from ASBMB News (March-April 1999), a bimonthly publication of The American Society for Biochemistry and Molecular Biology. ASBMB collected data on graduations from academic institutions granting biochemistry and/or molecular biology degrees (See Table A). The survey was sent to 438 schools; 256 schools responded.

Table B (page 3) notes the institutions returning surveys listing the most graduates in different categories.

Lastly, we would like to take a moment to say thank you for the warm response we have received toward our newsletter. Please continue to send us your comments, feedback and inquiries. We also ask that you take a few moments to answer the hot topic question. Your answers assist us with our research. Visit <http://www.ehr.nsf.gov/ehr/hrd/mge.asp> for additional information on the NSF Minority Graduate Education program.

## MGE Alliances Being Established

At the National Science Foundation, the FY 1999 Program Announcement and Guidelines for the MGE program are currently being revised for FY 2000 to reflect a change from supporting individual institutions to supporting alliances of doctoral-degree granting institutions. As a result of this

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revised emphasis on the formation of alliances, the NSF Minority Graduate Education (MGE) program will undergo a name change which will be announced as soon as the new FY 2000 Program Announcement and Guidelines has been approved. This emphasis on "alliances" creates a better alignment with the primary goal of the MGE program, which is to increase the number of minority students pursuing advanced study, obtaining doctoral degrees, and entering the professoriate in SME disciplines. In a practical sense this means increasing the average graduation rate of minority Ph.D.s rate from a current rate of 600 per year to 2,000 per year in the next five years of the program.

**New Awards:** In keeping with the focus on the formation of graduate Alliances, NSF has made ten new university awards in FY 1999 that will result in the formations of 7 new MGE graduate alliances. These alliances, which may be either statewide or regional, with one institution serving as the "Lead Institution will work cooperatively to increase the number of underrepresented minority Ph.D. graduates in SEM. These are shown below:

- Arizona State University will form an Alliance with 6 area universities.
- State University of New York at Stony Brook will form an alliance with universities in the SUNY system.
- University of Mass, Amherst will form an alliance with several New England area universities.
- U. C. Irvine, U. C. San Diego and U. C. Berkeley will form an alliance with the 9 campuses of the UC system.
- University of N.C. at Chapel Hill and North Carolina State University at Raleigh will form a State of North Carolina Graduate Alliance.
- A state-wide Mississippi MGE Alliance has been formed with the University of Mississippi serving as the lead institution.
- City University of New York (CUNY) will form an Alliance with several area universities.

The eight universities that received MGE awards in 1998 are Georgia Institute of Technology, Howard University, University of Alabama at Birmingham, University of Florida, University of Michigan, University of Missouri-Columbia, University of Puerto Rico and Rice University.



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## Multicontextuality: A New Perspective on Minority Underrepresentation in SEM Academic Fields

*By Robert A. Ibarra, Ph.D.  
University of Wisconsin-Madison*

A perennial question in higher education is why do most Latinos and other minority graduate students select academic careers in the social sciences or humanities? A related question is why are so few of these ethnic minorities seeking doctoral degrees in the biological and physical sciences, engineering or mathematics-SEM for short? Latino graduate students, for example, share a history of seeking degrees mainly in education, humanities, and the social sciences. Despite increases in doctorates awarded to Latinas (45%) and Latinos (30%) in the sciences between 1987 and 1996 (National Science Foundation, 1997:37-41), the chronic underrepresentation of women and ethnic minorities in these fields sends researchers looking for solutions to increase the diversity in these disciplines (see Clewell and Brown 1999; National Science Foundation 1995, 1996; Seymour 1995; Seymour and Hewitt, 1997).

Among Latinos, there are a number of possible factors creating these patterns. For instance, bilingual Latinos, and especially immigrants, are naturally attracted to the language and culture of Spanish departments that offer degrees with more career opportunities than many other fields. Latino enrollments are often the highest in Schools of Education because they tend to attract more women, consequently there are more Latinas in those fields. The most common explanation is that since many Latinos attend poor elementary schools, they are usually unprepared to compete academically, or they do not perform as well, as other populations that traditionally dominate SEM programs. Thus, Latinos are found more often in the "soft sciences" that reflect more qualitative characteristics than in the "hard sciences," that are characteristically more quantitative.

**Concepts of Multicontext Theory**

Virginia Van Horne

**Art Director:**

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I believe there is yet another overlooked perspective for explaining why Latinos and other ethnic minorities are underrepresented in SEM fields. To begin with, the concern over academic clustering is usually defined by what Latinos are less likely to study, namely SEM fields, rather than what they prefer to study and why. Many social science, education and humanities disciplines are well known for their characteristics of cultural context and social sensitivity, and they attract minority students for their orientation toward people, social interaction, and the community. The attraction is not associated with just any applied field. For instance, Latinos can be attracted to highly analytical or quantitative professional disciplines, such as law and medicine, because they also provide applied skills that directly help people and the community (see Ibarra, 1996; and in press). One research university administrator commented recently that recruitment and retention of Latino students was directly associated with the presence or absence of applied community-oriented academic programs. He noted that Latino enrollments dropped dramatically on his University of California campus whenever academic departments downsized by eliminating their applied programs (Leadership Summit on Diversity in Doctoral Education, personal communication, 1999).

But these patterns represent only the tip of a cultural iceberg, for much more lies hidden beneath the surface. Recent research on Latinos in graduate education (Ibarra, 1996) framed these patterns into a theory of Multicon-textuality, a new construct for explaining the conflict and academic performance differences for Latinos, women and other ethnic minorities in higher education (Ibarra, in press). The theory was partially constructed from cultural models developed by anthropologist Edward T. Hall, a pioneer in the field of intercultural communication (1959, 1966, 1974, 1977, 1984, 1993). Learned patterns or sets of behavior and values we call "culture" are imprinted on individuals by family and community beginning at birth. These conscious and unconscious patterns frame the "context" for individuals to perceive, interact and learn about the world. Hall identified populations both here and abroad by their similar patterns of cultural context and clustered them on a continuum from "High" to "Low" signifying the importance of these patterns within certain ethnic, gender and national origin groups.

"High Context Cultures" (HC), identified in this country as predominantly ethnic minorities and females, tend to focus on streams of information that surround an event, situation or interaction in order to determine meaning from the

context in which it occurs. "Low Context Cultures" (LC), predominantly northern European ethnic groups and majority males, tend to filter out conditions surrounding an event or interaction to focus as much as possible on words and objective facts. [Table 1](#) synthesizes selected cultural characteristics that highlight almost thirty years of Hall's research on patterns of cultural context.

Cultural context issues usually focus on the fundamental conflicts between individuals from certain High and Low Context ethnic and gender groups. Although the model has not been fully applied to ethnic minorities in higher education, it seems to account for much of the conflict and confusion arising from Latino graduate students and faculty interviewed in the research project (Ibarra, 1996). For Latinos struggling for success in graduate education, the research discovered that the greatest conflicts are associated with Low Context cultural value systems and infrastructures of academia itself.

Academic cultures, especially those associated with graduate education, trace their origins to Low Context cultures (Ibarra, in press). For instance, doctoral education in the U.S. was transported here in the mid-1800s as a German research model. German national cultures, according to Hall, are the epitome of Low Context cultures throughout the world. Some aspects of academic cultures and graduate education, such as graduate seminars and the internship learning model, seem High Context in nature, but most aspects of higher educational systems are shaped and imprinted by learning modes created by and for Low Context cultures. The consequences in graduate education have direct and often negative effects on many people from High Context cultures.

The Theory of Multicontextuality is an amalgamation of cultural context and cognitive models. It postulates that a growing number of individuals now entering higher education today are mixtures of multiple cognitive and cultural contexts. Successful individuals learn and formulate adaptive strategies that display characteristics interchangeable with models of "Cultural Context" (High and Low) and "Bicognition" associated with dual cognitive perspectives. "Cultural Context" is a macro model of human culture. It represents a binary continuum along which a range of cultural characteristics may be found to identify and measure differences between various cultural groupings. As such, it transposes the characteristics of larger groups and populations into labels that characterize individuals who consider themselves members of those groups. "Bicognition"

is a micro model of human psychology developed by Clinical Psychologists Manuel Ramírez III and Alfredo Castañeda (1974) and refined further by Ramírez predominantly (1998, 1999). Bicognition represents a variability of individual personality and cultural styles generated by two distinct cognitive (Field Sensitive and Field Independent) conditions within individuals. Thus, it transposes these psychological characteristics of individuals into labels that characterize larger cultural groups and populations within which individual identity is validated. These distinct cognitive conditions share similar characteristics with cultural context models (see Ibarra in press). To facilitate discussion, however, primarily macro context models will be applied here.

### **Multicontext Factors in Higher Education<sup>1</sup>**

Latinos and other ethnic minorities may be more attracted to certain academic careers because they share both macro and micro characteristics of High Context cultures (see Table 1). Further-more, there is evidence that Latinos and other minorities can be more successful academically in SEM disciplines if they effectively incorporate some High Context principles. For example, Uri Treisman (1988) discovered for some ethnic minorities learning difficult (and Low Context) subjects, such as calculus, that academic performance can be improved by simply applying teaching/learning methods that require studying in groups-a High Context characteristic. While academic preparedness is an important factor for faculty to consider when admitting students into SEM graduate programs, academic culture, cognition and Multicontext fit are also important factors for Latinos and other minorities to consider when selecting an academic degree.

A recent study of undergraduates by Seymour and Hewitt (1997) provides evidence to support this concept of culture, cognition and fit and sheds new light on patterns of underrepresentation in SEM fields at the graduate level as well. We know that the undergraduate and graduate fields least populated by Latinos are the biological, physical and health sciences, public administration and engineering (see Ibarra, in press). In fact, at the undergraduate level the attrition rate for Latinos in SEM disciplines is the highest at 75 percent, compared to 50 percent for African Americans and Native Americans each, over 27 percent for Anglos and only 17 percent for Asian Pacific Americans according to Seymour and Hewitt (1997:320). To find out why undergraduates leave the sciences, the authors launched a qualitative study of seven institutions that included an examination of cultural differences among ethnic groups of

undergraduate students and their consequences for switching out of their SEM majors.

Seymour and Hewitt (1997) interviewed 335 current and former SEM students with math SAT scores (or their equivalent) of 650 or above. Half had switched out of SEM majors and half had not. Of all students interviewed, 88 were students of color (African American, Asian American, Native American, and Latino/a). Eleven of the 20 Latinos were switchers and nine were non-switchers. One of the study objectives was to compare the switching and persistence factors embedded in the accounts of students of color with those of the white majority. On a macro level of analysis, the authors initially sorted these factors into two groups differentiated only as "White Switchers" and "Non-White Switchers" (changed here to "Majority Switchers" and "Minority Switchers"). They then disaggregated the text data by minority group at a micro level of analysis in order to understand the different cultural factors bearing upon the decisions of students in each group. In a ranked list of ten macro level factors, reproduced in Table 2, the authors focus on items indicating the greatest percentage of difference between students from the four minority groups taken together and the majority (white) group. That pattern revealed minorities have greater difficulty than majorities with choice of SEM major that proves appropriate, conceptual difficulty with one or more subjects, and inadequate high school preparation. Majorities, in comparison, cite loss of interest, poor teaching by faculty, and curriculum overload or fast pace as their top three reasons for switching.

However, viewed through the perspective of Multicontext theory, the macro level data reveal other important and previously unnoted patterns for why minority students switch SEM majors. Based on priority ranking alone, the top three reasons given for why minority students switch to non-SEM majors suggest preferences toward academic content and fit: (1) they were more educationally appealing; (2) they may have been the more appropriate choice of a college major to begin with, and (3) non-SEM majors offer better careers. The least important reasons for why minorities switch majors relate to academic ability and preparedness: (7) inadequate high school academic preparation; (8) low grades in early years, and (10) curriculum overload or overwhelming pace. Even poor teaching by SEM (9) ranks lower on the list among minority respondents.

From this, one could argue that within a combined group of academically able students from different ethnic groups, the appeal of non-SEM majors and associated careers are the top three most important factors for leaving the sciences or

switching majors, while mainly academic reasons are the least important factors. The reverse also seems to be true; that is, despite the fact that some groups of ethnic minority students realize they received less than adequate high school preparation (1997: 328-329), minority students leave or switch majors because they become less enchanted with SEM majors and more attracted to non-SEM majors. Indeed, issue (5), the loss of interest in SEM or "turned off science," and (6) rejection of SEM careers/associated lifestyles reflect this pattern. Even issue (4) conceptual difficulties with one or more SEM subjects, reflects conflict with academic content, cognition and Multi-context fit. One conclusion from the data presented in [Table 2](#) is that issues involving academic content or culture constitute over half of the top most highly ranked factors contributing to switching decisions among minorities in their study.

One could interpret these patterns further by stating that Minority Switchers become attracted to non-SEM disciplines with more High Context characteristics (see Table 1). If non-SEM majors are those that are more likely to be found in disciplines with more High Context characteristics, then there is good reason to believe that context, cognition and cultural fit are very important factors. In fact, these factors may be directly associated with some of the major influences that convince ethnic populations to leave science majors, and perhaps, discourage them from choosing to pursue SEM majors altogether. That Latinos are entering SEM undergraduate majors in greater numbers is a testament to their ability to master Low Context academic disciplines involving linear, analytical thinking, while maintaining High Context cultural values of the family and community-the essential characteristics found among successful women and ethnic minorities in graduate school (Ibarra, in press).

The preceding interpretations of macro level data in Table 2 are meant to be more illustrative than conclusive that Multi-context factors influence the decisions of minority switchers. But they provide researchers with another perspective to examine the issues. For instance, why do some minorities who enter science disciplines find them unattractive and decide to switch? That Latinos and other ethnic groups with academic abilities leave in droves for non-SEM majors suggests something is amiss within the academic cultural systems and infrastructures of these majors, and either voluntarily or involuntarily turns them away. These answers, however, are not easily found by macro level data alone. That level of analysis may be incomplete, can distort outcomes and all too often misleads educators into thinking that some commonality of issues among diverse ethnic

groups equates with a common set of solutions for their various needs. A more fruitful approach is to seek answers and solutions for these issues at the ethnic group or micro level of analysis (Seymour and Hewitt, 1997; Ibarra, in press).

Even at the micro level of analysis, the pattern of Multicontextuality, related to the conflict encountered between High Context cultures and academic culture, is borne out in the research findings of Seymour and Hewitt (1997). They found that "to succeed in S.M.E. careers, male [minority] students and all women often find it necessary to alter or over-ride important personal values. Those unable to discard cultural values that hinder individual success are vulnerable either to changing majors or to abandoning the attempt to attain any degree," (1997:330, italics added for emphasis). I suggest that students who can over-ride or set aside personal and cultural values without discarding them, are Multicontext individuals and are most likely to succeed in higher education through graduate school.

One way to successfully alter personal values without discarding them is to recreate High Context conditions in an academic environment. For example, the authors found that Latino undergraduates who recreated family-like relationships and infrastructures on campus, such as extended kin networks and other support groups, were less likely to drop out of the institution (Seymour and Hewitt, 1997:330). Furthermore, when the authors found incidences of high Latino persistence in an academic program, the institution also demonstrated a strong commitment to creating infrastructures that emulated the extended family/community cultural systems (e.g., group residency units providing self-contained academic, financial and other student support services). It appears that each of these personal and institutional activities are successful because they recreate important macro level characteristics found in High Context cultures, and they adopt them to the priority needs for specific ethnic populations at the micro level.

### **Implications Beyond the Baccalaureate**

In conclusion, my research among Latino graduate students and faculty agree with many observations by Seymour and Hewitt, and that includes recommendations that academia should accept some of the responsibility for contributing to the chronic problems of underrepresented populations in SEM fields. Many educators assume that to be successful in higher education one needs to conform to the system rather than have the system adopt additional strategies and conditions to meet the needs of different cultural contexts

among students. And in most cases, adjusting the system and structures to include High Context cultural values would neither diminish SEM academic culture nor relinquish the rigorous nature of scientific inquiry. Yet, educators and administrators continue to ignore this opportunity for cultural change and structural reform. And each year when student and faculty statistics show little change in the diversity of SEM programs, they ask the perennial question- "What is driving our students away?"

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<sup>1</sup> I wish to thank Dr Elaine Seymour for reviewing this paper and providing valuable feedback and suggested changes for this section.

## References

Clewell, Beatriz Chu and Shirley Vining Brown. 1999. "The Non-SEM Field Choices of Black and Latino Undergraduates with the Aptitude for Science, Engineering, and Mathematics Careers." *Making Strides*. Washington, DC: Directorate for Education and Human Resources programs, American Association for the Advancement of Science, 1-1: 8-11, April.

Hall, Edward T. 1959. *The Silent Language*. Greenwich, CN: Fawcett Publications.

1966. *The Hidden Dimension*. 2nd ed. Garden City, NY: Anchor Books.

1974. *Handbook for Proxemic Research*. Washington, DC: Society for the Anthropology of Visual Communication.

1977. *Beyond Culture*. 2nd edition. Garden City, NY: Anchor Books.

1984. *The Dance of Life: The Other Dimension of Time*, 2nd ed. Garden City, NY: Anchor Press/Doubleday Books.

1993. *An Anthropology of Everyday Life*, 2nd ed. Garden City, NY: Anchor Books.

Ibarra, Robert A. 1996. *Latino Experiences In Graduate Education: Implications for Change*, Enhancing the Minority Presence in Graduate Education VII, Washington, DC: the Council of Graduate Schools.

(In press). *Academia at a Cultural Crossroads: Reframing the Context of Higher Education*. Madison, WI: The University of Wisconsin Press.

Leadership Summit on Diversity in Doctoral Education.

1999. Co-sponsored by the US Department of Education and Howard University, June, 1999, Washington DC.

National Science Foundation. 1995. *Science and Engineering Degrees, by Race/Ethnicity of Recipients: 1985-93*. (NSF 95-330), Arlington, VA.

1996. *Women, Minorities, and Persons With Disabilities in Science and Engineering: 1996*. (NSF 96-311), Arlington, VA.

1997. Division of Science Resources Studies. *Science and Engineering Degrees, by Race/Ethnicity of Recipients, 1989-95*. NSF 97-334, by Susan T. Hill, Arlington, VA.

Ramírez III, Manuel. 1999. *Multicultural Psychotherapy: An Approach to Individual and Cultural Differences*. 2nd ed. Boston, MA: Allyn and Bacon.

-and Alfredo Castañeda. 1974. *Cultural Democracy, Bicognitive Development, and Education*. NY: Academic Press.

Seymour, Elaine. 1995. *The Loss of Women from Science, Mathematics, and Engineering Undergraduate Majors: An Explanatory Account*. *Science Education*, 79 (4):437-473.

-and Nancy M. Hewitt. 1997. *Talking About Leaving: Why Undergraduates Leave the Sciences*. Boulder, CO: Westview Press.

Treisman, Uri P. 1988. A Study of the Mathematics Performance of Black Students at the University of California, Berkeley. In *Changing the Culture: Mathematics Education in the Research Community*. N. D. Fisher, H. B. Keynes, and P.D. Wagreich (eds.), CBMS Issues in Mathematics Education, Vol. 5, American Mathematical Society.

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## **Multicontextuality Unpacked: Comments of Dr. Ibarra's Paper**

*By Shirley M. Malcom, AAAS*

Ibarra approaches the problem of minority underrepresentation in the academic fields of science, mathematics and engineering from the perspective of the students and the cultural contexts that such students bring—raising some interesting and provocative issues.

Interestingly, critics of the current higher education system echo the strategies that Ibarra is proposing: broadening the experiences provided as part of graduate education, focusing on problem-focused interdisciplinary work, expanding the reward system beyond a narrow emphasis on research and publications, requiring small group work to support education in calculus and physics and working in diverse teams.

Industry needs personnel who can work in global markets. Universities need faculty who can teach an increasingly diverse student population. Government needs employees who can focus on complex problems that affect all of its population. Whether we like it or not, the structure of higher education in science, mathematics and engineering will have to evolve in order to serve its larger role within society.

Virginia Van Horne

**Art Director:**

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## **An Interview with Dr. Sheila E. Brown**

*By Virginia Van Horne  
Senior Research Associate*

*Each issue of Making Strides features a short interview with an underrepresented minority SME professor who has been instrumental in mentoring and encouraging students through the pipeline, as well as demonstrating leadership and outstanding accomplishments in the world of SME.*



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*This month I had the opportunity to chat with Dr. Sheila Browne, a Professor of Chemistry at Mount Holyoke College. She received her B.S. degree in Chemistry, magna cum laude, from the University of Tennessee in 1971, and her Ph.D. in Organic Chemistry from the University of California, Berkeley, in 1974. She was a Visiting Professor of Chemistry at the University of Hawaii, 1984-1985, and a Visiting Professor of Polymer Science at the University of Massachusetts, Amherst, 1992-1993. In addition to her research and publications on biodegradable polymers, Dr. Browne is well known for her presentations on mentoring and increasing opportunities for those underrepresented in the sciences. Having spent a great part of her career encouraging women and minorities in science, she received the Presidential Award for Excellence in Science, Math and Engineering in Mentoring in 1998.*

### **How did you become interested in science?**

My third grade teacher, Mrs. Lawrence, introduced me to the wonders of science. We did extensive projects on space and on the human body that piqued my interest. I still remember giving a presentation on the digestive tract we pulled yard after yard of small intestine from our life size model of the human body. School was a lifesaver for me. I grew up in a very poor family in Appalachia, in the mountains of Tennessee. Both of my parents were alcoholics and life at home was a violent experience. School was the only safe place I knew and I can never say enough about how much the support and encouragement of my teachers meant to me. I firmly believe that they saved my life and deserve the credit for everything

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I have accomplished. I think understanding the difference they made in my life was a major reason I became a teacher.

Part Cherokee, I was the first in my extended family to graduate from high school. My grandfather was a scholar in our community. Since he made it through the third grade, he could read and write, while many in our community could not. By the age of 14, my mother was working in a factory. My family really was not able to support my interests in school or in science.

**Did you know when you were in high school that you would go to college?**

Actually, no. While in high school, I worked as a waitress to help with the family finances. I worked until 10:00 p.m. on school nights and ten hours on Saturday. I was so tired after work that I couldn't even smile! Seeing the waitresses who had been doing this for 30 years convinced me that I had to do something else with my life. Most of the men in the family had jobs on the railroad; the women worked in factories or took care of families. A cousin of mine married at 13 and had four children by the time she was 17! I didn't want to follow in my family's footsteps. College seemed to be the answer.

In 1966 I applied to the State University because it was the cheapest place I could attend. The University gave me a scholarship and I received workstudy funds from the Appalachia Poverty Program. Just before I was to leave for college, our preacher came to our house to try to convince my parents to not let me go to college.

**Tell us about your undergraduate experience.**

When I arrived at the University of Tennessee in 1966, I literally didn't know what a Ph.D. was or what it took to be a professor. My goal at that time was to become an M.D. I wanted to return to my hometown and help my community. It seemed like a great idea, but I knew medical school tuition was very expensive and really didn't have the foggiest idea as to how I'd pay for such tuition.

I enrolled in premed classes and in my sophomore year took Organic Chemistry. I loved it. I liked thinking about it, studying it and soon learned that I especially loved the research. Not only did I enjoy chemistry, but I was doing quite well in the class. My professor, John Larson, invited me to join his research team. I was an undergraduate and I was working in the lab alongside graduate students! It was amazing. It was under Dr. Larson's guidance that I chose to pursue a career in chemistry. He pointed me toward graduate schools and helped me complete my application to the University of California, Berkeley.

In 1971, while at the University of Tennessee, I was selected for Phi

Beta Kappa and was one of 12 students selected for the Mortar Board for campus leadership.

### **And?**

Each year of college I received less money from the University of Tennessee and had more jobs. I was constantly afraid that the money would run out before I could graduate. Because I enjoyed chemistry so much, I decided not to pursue medical school. Knowing how difficult it was to pay for my undergraduate tuition, paying for medical school seemed impossible. Ultimately, I also realized that I didn't want to be in responsible for life and death situations.

### **Did you have any difficulties-either as an undergraduate or as a graduate student?**

Yes! Money was a constant source of anxiety, and I encountered my fair share of "terminators."

### **"Terminators?"**

A "terminator," is a word I use to describe a certain type of individual a person who terminates your progress. Its someone who undermines your confidence in a lab or greets you with an "are you sure you're in the right classroom?" type of remark. Terminators are the people who have a preconceived notion of who you are and what you can be. For example, in addition to loving chemistry, I loved physics and I thought initially that I would be a physics major. As a sophomore, I took an advanced class in electromagnetism. We were calculating the gaussian fields of capacitors, but I knew next to nothing about electronics. After class, I asked the professor if he could let me borrow a simple text on electronics. Despite my being one of the top-scorers in his class, he told me that since I was a woman, he would not waste his time. I would never understand the topic anyway. It was a frightening revelation to me that no matter how well I did on exams or in the lab, nothing I could do would change his opinion of me. Being young, I assumed all physicists would have this same attitude and I gave up on physics. I began to focus solely on chemistry. Nowadays, I warn my students about "terminators" and offer strategies to limit the power of such people.

### **Is this why are you such a strong supporter of mentoring students?**

I've met people who have left science because of a terminator. Mentors, however, can make a real difference. If you have a mentor, you can discuss your fears and concerns with her or him. Terminators are subtle. They would rarely, if ever, make a blatant discriminatory statement in front of their colleagues. From my own

experiences, I know what kept me going. During my precollege years it was my local teachers. As an undergraduate it was John Larson. Having someone believe in you and in the possibility of your dreams is a very powerful thing.

I asked the 70 successful minority scientists in the New England Board of Higher Education network what made a difference in their "making it." Every person I spoke with gave credit to a mentor-whether an elementary teacher, a grandmother, or a college professor-that was instrumental in pushing them forward. Many of these mentors were white males. Afterall, who else was in science at that time? I decided that if I could create more mentors, it would open doors for women and minorities in science. I enjoy mentoring students and running workshops to teach others how to mentor minority students in science. At Mount Holyoke College, I helped in the creation of two student groups Native Spirit and 'Sistah's' in Science that offer very powerful peer support and mentoring. This is why I make it a point to travel to various universities and conferences and speak on the need for good mentors and mentoring and how to make it happen.

### **Tell us about graduate school.**

I graduated in 1971 from the University of Tennessee and drove across country to California. It was the ultimate culture shock! At the University of Tennessee I had been considered a liberal; at the University of California, Berkeley, I was very conservative. I was one of two women-out of close to 140 entering graduate students-in organic chemistry. There were no women faculty at Berkeley (or at the University of Tennessee) in chemistry at that time. I worked under Andrew Streitweiser, Jr., who clearly loved chemistry and was very generous in letting me join his group. At that time, there were several male faculty who would not even take women as graduate students. It was a very stressful time for me. The other graduate students were from schools like MIT or Cal Tech, and I felt I was constantly trying to catch up. Over half of my entering class quit. The excitement of the research work kept me going.

During my first year at Berkeley, my Mother called to encourage me to take a shorthand class, because there were always jobs for secretaries. When I received my Ph.D. in 1974, my father asked me how much money I was paid for my "book". When I explained that it had cost me \$50 to submit it, he never again asked me about my work. They both wanted to know if I would ever stop going to school and get a job.

In 1974 I graduated with my Ph.D. in organic chemistry. I married the man who worked in the lab adjacent to mine, and we moved to Massachusetts. My husband had gotten a job at Worcester Polytechnic Institute (WPI). We didn't even think about trying to get a joint appointment. I worked as a teaching assistant at WPI for one

year and then went to Brandeis University to do postdoctoral work with Bill Jencks in the biochemistry department. While I was in the postdoc, a colleague, Joanne Stubbe (now a tenured chemistry professor at MIT) said she had interviewed at Mount Holyoke College (MHC) but was not interested. Was I? I sent in a late application, interviewed and was hired within 4 days. I've been teaching courses in chemistry, environmental studies and women in science for the Women's Studies department at MHC ever since.

In 1984 I received tenure from Mt. Holyoke. After that I took a one-year sabbatical and did research on natural products while teaching chemistry at the University of Hawaii, Manoa. I was an associate professor from 1984-1990 and became a Professor of chemistry in 1990. I also chaired our department from 1990-1992. And, in 1992-1993 I was a visiting professor of Polymer Science doing research on biodegradable polymers with Dr. Bob Lenz at the University of Massachusetts, Amherst. Doing research across the borders of a discipline is most interesting for me and seems to offer an environment that is more flexible and accommodating to differences in people and how they think.

**How did you feel about being a Presidential Awardee for excellence in science, mathematics and engineering in mentoring winner?**

When I received this award in 1998, I was in shock. I read the supporting letters written by students, and was amazed that I had had such an impact on their lives! This award has given me more credibility for the things I want to do. It's a stamp of approval. I can now get people enrolled in the programs I have done since I have an award indicating that these mentoring programs are working!

**Please elaborate more on your role with students.**

The first thing I look for in my students is that they want "it." In other words, I want to know that they are interested in science and want to do science. It is crucial to support what my students dream of doing. I do not want to push them into doing something that I think they should do. It is important to believe in them. I also try to make sure they are aware of all of the opportunities available. I run mentoring programs and seminars, such as Sistah's, on finding science internships and I have created a web site with links for science, math and engineering disciplines. Once students are in a research lab and working, they can see themselves as professional scientists! I personally take students, in my van, to conferences. I'll do my best to find funding for students so that they can attend conferences such as the National Organization of Black Chemists and Engineers, the American Indian Society for Engineering and Science, the Society for the Advancement of Chicanos and Native Americans in Science, etc., and meet successful people like themselves and find more mentors.

I make a point of staying in touch with most of my students via e-mail and telephone. Students who have graduated 24 years ago still call me! I try to keep an active network of former students who are willing to talk to current students, give advise and answer questions as well as keep me informed of job openings and events.

### **What next?**

I've been giving presentations across the country to science faculty on how they can make a difference in working with women and minorities. I'd like to do more of this and give workshops for science departments on how to mentor minority students as well as create organizations like "Sistahs." I want to have an impact. In the future I hope I can work at a foundation, or an agency, such as NSF, helping people further their work. My dream is for departments across the country-e.g., departments that receive government funding-to require their entire faculty to take a course on mentoring. In short, systematic change for science departments!

### **Thank you Dr. Browne.**

*For further information on Sistahs in Science, please visit*

<http://www.mtholyoke.edu/courses/sbrowne/sistahs/final/title.shtml>.

*For Finding Research Internships, please visit,*

<http://www.mtholyoke.edu/courses/sbrowne/sistahs/final/index.shtml>.



**Research  
News On  
Minority  
Graduate  
Education  
(MGE)  
Volume 1  
Number 3**

## **A Comparative study of the Impact of Differing Forms of Financial Aid on the Persistence of Minority and Majority Doctoral Students**

*By Beatriz Chu Clewell,  
The Urban Institute and Vincent Tinto, Syracuse University*

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**Managing  
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George  
**Editor:**  
Virginia Van Home

Existing data and literature on doctoral persistence indicate a national failure to attract and retain graduate students, especially those of minority origins. Not only are the numbers of minority students completing their degrees low and in some cases falling, persistence rates are disturbingly low. In studies of doctoral persistence, financial aid emerges as one of the most prominent factors having a direct impact on the process. While financial concerns affect the general population of doctoral students, they are particularly acute for minority and women students. It is not merely the existence of financial aid that has an impact on persistence; the actual type of assistance and timing, can greatly affect the effectiveness of the aid. For example, fellowships or assistantships have been correlated with full-time attendance, student retention and the rate of progress students make towards their degree.

This study examines how different forms of financial aid (e.g., fellowships, research assistantships, and teaching assistantships) within a particular institutional context shape student's experiences in doctoral study, and how over time those experiences influence the completion of doctoral degrees in Engineering, the Physical and Natural Sciences, and Social Sciences. The focus is on both identifying the relationships between types of financial aid and degree completion and understanding the context in which the relationships arise, specifically, the patterns of interaction between students and faculty. We examine experiences across gender and race, especially for students of African-American and Hispanic origins.

**Art Director:**

Ann Williams

*Making Strides* is a free, quarterly (April, July, October, and January) research newsletter published by the American Association for the Advancement of Science, Directorate for Education and Human Resources Program. Its purpose is to share information about minority graduate education (MGE) in the fields of science, mathematics, and engineering. It is available in print and electronic format. Inquiries, information related to MGE, and all correspondence should be sent to the editor.

The study sample included 251 male and female African-American, Hispanic, and Anglo-American doctoral students in the Natural and Physical Sciences, Engineering and the Social Sciences who began their doctoral studies at two chosen universities from 1985 onwards. Our theoretical and empirical work centers on the factors that influence doctoral student persistence, the variation among different fields of study (particularly for students of different gender and ethnic backgrounds), and the different types of financial aid. The model incorporates both retrospective survey methods to examine what events shaped doctoral persistence, and qualitative methods to gain a better understanding of how minority student persistence is shaped by institutional events and by different forms of financial aid packaging. This combination approach should yield more reliable research to inform the development of future policy.

One of the most salient findings indicates that the importance of the context in which the financial aid is administered cannot be underestimated. The results do not substantiate extant theories that financial aid has a direct impact on doctoral persistence. Instead they demonstrate that financial aid has an indirect effect on the process. This conclusion is drawn from the observed relationship between type of aid and student satisfaction with doctoral study. Central to this relationship is the importance of student interaction with and subsequent satisfaction with the faculty in the program.

Policy recommendations from this study stem from three primary findings that have direct implications for the way financial aid is structured and administered. First, financial aid has an indirect effect on persistence through its effect on student interaction with faculty and time to degree, and aid should be structured in such a way that maximizes these possibilities. Second, the data also show that a comprehensive, multi-year financial aid package is the single most important factor influencing students' choice of a doctoral program. Schools should ensure that they are able to make competitive offers to students. Finally, since context is of great importance at the graduate level, financial aid policies should be flexible enough to accommodate differences of academic field and institutional setting as well as individual student needs.

*Editors' Note: The authors adapted this article from the Executive Summary of the final report (of the same title) submitted to the National Science Foundation in 1999. For a copy of the executive summary please contact:*

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**Managing  
Editor:** Yolanda S.

## **A Profile of an MGE Institution: Georgia Tech**

*By Gary S. May,  
Associate Professor, Electrical and Computer Engineering*

The MGE program, "Facilitating Academic Careers in Engineering and Science" (FACES), is a collaborative effort between the Georgia Institute of Technology, Morehouse College and Spelman College. FACES represents a blending of commitment of the resources of these three institutions and the National Science Foundation to focus specifically on increasing the production of African Americans who earn engineering and science doctoral degrees. This program was initiated and is managed by African- American faculty who are committed to this goal and recognize that success breeds success. At steady state, the FACES program will produce ten additional African-American doctoral recipients per year, thereby doubling Georgia Tech's output.

The FACES program is comprised of several components, each of which addresses a critical step along the path to an academic career. Undergraduate students who have completed their junior year are provided summer and academic year research experiences as a means of promoting their interest in research and graduate school attendance. This year, 22 students from schools around the country participated in the summer undergraduate research program. These students, as well as other worthy candidates, will be encouraged to enroll in graduate programs using a series of recruitment efforts at national events such as the National Society of Black Engineers Annual Convention, campus visits and tours, and a lecture/workshop series on the merit of graduate school and careers in academia.

Admitted graduate students are partially supported on doctoral fellowships throughout their matriculation through graduate school. This support is provided by means of a stipend that increases in value as the student meets the critical milestones along the way toward the Ph.D. degree. The first ten FACES fellows were admitted into various

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engineering and science programs this fall. Funds are also available to support travel by the FACES Fellows to technical meetings for research presentations.

Finally, senior doctoral candidates at Georgia Tech can compete for \$20,000 career initiation grants which they may use as start-up funds to assist them in establishing their research programs in their initial academic appointments. Three such grants were awarded this year. The recipients (and the institutions at which they will be teaching) are Dr. Comas Haynes (Florida A&M University), Dr. Mark Lewis (University of Michigan), and Dr. Joseph Owino (University of Tennessee, Chattanooga). Institutionalization of the FACES program will be facilitated by the establishment of endowed faculty chair positions at each of the participating institutions. These chairs, which will be filled on a rotating basis with a five-year term, will serve as directors of the FACES management team and will be responsible for supervision of FACES activities, planning new initiatives, program evaluation, and student tracking. The chaired positions will provide the long-term leadership necessary to continue oversight of FACES after the initial five-year period of NSF funding ends.

FACES is managed by a steering committee consisting of Professors Reginald DesRoches, Augustine Esobue, Gary S. May, Stephen M. Ruffin, Mark J.T. Smith, Jeffrey L. Streater, and S. Gordon Moore, Jr., all at Georgia Tech and Professors Etta Falconer of Spelman and Arthur Jones of Morehouse. This committee reports directly to Georgia Tech President G. Wayne Clough.

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