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

Inside this issue:

Managing Editor: Yolanda S. George
Editor: Virginia Van Horne
Art Director: Ann Williams

Wanted: A Better Way to Boost Numbers of Minority Ph.D.s

by Jeffrey Mervis (Reprinted with permission from *Science*, Volume 281, Number 5381 Issue of 28, Aug 1998, pp. 1268 - 1270.)

With set-aside programs under fire, "majority" institutions are being asked to find new approaches to achieve diversity.

For years, the National Science Foundation (NSF) has reserved a portion of its prestigious graduate research fellowships for minority students seeking to launch a career in science. By holding a separate competition among underrepresented minorities-notably, African-Americans, Hispanics, or American Indians-for approximately 15% of the 900 slots, NSF officials hoped to increase their pitiably small number in academic science. But yesterday, when NSF announced the rules for its 1999 awards, the minority component was gone.

The decision is triggered by a recent pretrial settlement of a white student's lawsuit claiming that the separate competition discriminated against majority students (*Science*, 26 June, p. 2037). And it's part of a much broader review of some two-dozen NSF programs, which last year received $110 million to help diversify the U.S. scientific work force. "This is a big issue," says Joe Bordogna, acting deputy director of NSF, who oversees the effort.

NSF is not alone in questioning such activities. In the wake of a string of legal and political reversals for affirmative action programs, federal agencies, universities, and private foundations are seeking ways to increase the number of minorities in science without running afoul of the law. They range from trying to change the culture of research universities to promoting mentoring and building bridges between predominantly white institutions and historically black colleges. Some also try to "prime the pump" by

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reaching down into high schools or even earlier, and others also target women, an underrepresented minority in many fields.

A shaky record

This rethinking is coming at a time when, despite more than a generation of programs aimed at giving minorities a greater opportunity to compete for scientific Careers, all but Asian-Americans remain dismally underrepresented in science. While African-Americans, His-panics/Latinos, and American Indians comprise 23% of the U.S. population, they make up only 4.5% of those holding scientific doctorates. When physicist and university administrator Walter Massey, president of Morehouse College and former NSF director, challenged graduate science departments almost 10 years ago to produce more minority Ph.D.s from underrepresented groups, he noted that many of them had yet to produce a single minority Ph.D. Recent figures show little change in that situation (see tables).

As universities struggle to improve their record, two events have complicated their efforts. One was a 1996 California referendum, Proposition 209, that makes it illegal for state institutions to use race-based criteria in admissions and hiring decisions. The other is a 1996 federal appellate court ruling, Hopwood v. Texas, that imposed a similar prohibition in Texas, Louisiana, and Mississippi. This fall, residents of Washington State will vote on an anti-affirmative action referendum, and educators are also awaiting the outcome of a pending suit that accuses the University of Michigan of discriminatory admissions policies. These decisions would apply only to specific states or institutions, however; the Supreme Court has yet to go beyond its 1978 Bakke ruling, which allows education officials to use race as a factor in their decisions.

That situation has created widespread confusion over whether a particular law, court decision, or agency policy applies to a specific action by an individual institution. "As private and public institutions, we're not supposed to have set-asides," says Gary Ostrander, associate dean for research in the arts and sciences at Johns Hopkins University in Baltimore. "But federal agencies like NSF and NIH can have [campus-based] programs that target minorities and that we must administer without violating the law. It's a fine line that we all walk." Private philanthropies like the Howard Hughes Medical Institute and the Sloan Foun-dation are also struggling with the issue.

Many science educators say that the recent judicial and

legislative activity has cast a pall over efforts to attract minorities into the profession. "It has a chilling effect on the groups you are trying to reach," says Herbert Nickens, head of minority programs for the 123-member Association of American Medical Colleges (AAMC), which in April issued a ringing 13-page defense of affirmative action in medical education. It calls the termination of such programs "a threat to diversity [that is] even more serious than the backlash in the mid-1970s." Notes Nickens: "Even as you're trying to drum up interest in academic science, it sends the clear message to minority students that, 'We don't want you.' "

However, others say that there's no point longing for something that's not coming back. "I think phase I of affirmative action is dead, and I don't lament its passing," says Richard Tapia, an applied mathematician at Rice University in Houston, Texas, and a member of the National Science Board, which oversees NSF. "It gave us a jump start, but it was never supposed to be permanent. Now, we have to find other ways to achieve real gains."

Continue

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REFORM STRUCTURAL TOWARD

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An Interview with Dr. Isiah M. Warner

By Virginia Van Horne
MGE 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 all levels of the education pipeline, as well as demonstrating leadership and outstanding accomplishments in the world of SME. For our inaugural issue, we had the privilege to chat with Dr. Isiah M. Warner, former Chairman of the Chemistry Department at Louisiana State University. Dr. Warner has always set high personal standards. For example, he completed his Ph.D. in three-and-one-half years, was the first analytical chemist to earn tenure at Texas A&M (1982) in over a decade, has published more than 180 research articles, and has trained more than 20 Ph.D. scientists.

How did you become interested in science?

I believe that I was born for science. I can remember watching family members pour some type of liquid into a kerosene lamp at two-years old. From this action, came fire. Naturally curious, I can remember wondering what that liquid was. Knowing the liquid was stored in a cabinet beneath the kitchen sink, I thought I could learn what it was by tasting it. Needless to say, I ended up in the hospital. That merely piqued my interest in science.

Why chemistry?

When I was ten-years old, my parents gave me a chemistry set. I loved it and would play with it for hours. When in high school, I can remember my English teacher asking me what

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I was going to major in while at college. Without pause, I said chemistry. At that time, Louisiana had segregated schools. Had I wanted to attend LSU, I would not have been able to. To provide a clearer picture, our school used textbooks that were five-to-seven years old; these were hand-me-downs from the white schools. Southern University, a Historically Black College and University (HBCU) located in Baton Rouge, offered scholarships. I can remember individuals from Southern coming to my high school and administering IQ tests. From such a test, I received a full scholarship to Southern University in 1964. I also participated in a summer program for juniors and seniors in high school. During the summer of my senior year, I attended Southern and took chemistry classes. The group that took these classes did so well, we were able to skip our first year of college chemistry.

Why did you go into industry after college instead of graduate school?

When I was coming out of school, it was the height of the Vietnam War; a relatively large fraction of African Americans were being drafted. Student deferments were no longer offered by the Draft Board. I had an interview with Battelle, Northwest; Battelle was a contractor for what was then the Atomic Energy Commission. My chances were very good that I could receive a job deferment. Battelle made me an offer and I took it, working for them from 1968-1973 doing technician-type work.

Why did you leave industry and return to school?

I was bored. I no longer felt intellectually challenged. I mistakenly thought I was bored because I was doing chemistry. Since my wife was working for a psychiatrist, she suggested I take an aptitude test. I did. The test indicated I was directly in line with a career in chemistry! This made me think about going on to graduate school.

Can you tell us about your graduate school experience? For example, did you encounter any challenges or difficulties?

I only applied to one graduate school, the University of Washington in Seattle in 1973. I knew that this university was the best in the area. The Seattle area-as my wife has always said--has incredibly positive race relationships. Although I was the only African American--out of 40 students in my class--I never encountered any problems at the University of Washington.

What made you become a professor?

That is an easy question for me. I knew from my experience as a teaching assistant, how much I enjoyed working with students. I can remember a young woman coming to me in tears after an exam. Thinking she had failed the chemistry exam, she told me she was planning to drop my class. I convinced her to continue. She ended up graduating as a chemistry major, with a 3.4 grade point average; she is now a medical doctor.

Do you have other examples of students you can share?

I have many examples! Encouraging and working with students is what matters. A young woman at LSU, who was married, worked in my lab. After a month of working for me, she told me she was pregnant and needed to quit. She contacted me a year later and asked if she could work with me again; I said yes. During this time, she underwent a divorce, yet kept working. Upon completion of her schooling, she asked me to write her a job reference letter. Having a variety of financial obligations, she wanted to begin working immediately. I told her she was too bright a student and that she should continue her schooling. I helped her investigate avenues, for example, applying to a graduate school near her family, applying for a fellowship, etc. This coming December, she will finish her Ph.D.

Recently, I received a letter from a young man I worked with as a participant in the American Chemical Society program, Operation SEED. We first met when he was in high school; he is now finishing up his Ph.D. at Georgia Institute of Technology. He thanked me for being a role model. These are the types of things that make teaching worthwhile.

What avenues did you pursue upon completing graduate school?

I interviewed at several universities. Texas A&M made me a fantastic offer, so I took it. Things changed at Texas A&M when I was granted tenure in 1982. For example, I was interviewed by the local paper and featured on its cover. In my interview I noted that there were not enough African Americans on the staff, faculty, or student body of the university. Needless to say, the President of A&M met with me and asked me to help do something to rectify this. I explained that I would be leaving to take a position at Emory as I had decided that I wanted to be at a smaller school and Emory was a small, private university. A&M, however, put together a committee to work on this issue of

underrepresentation.

Did you find that when you joined a campus, minority students sought you out?

Yes. When at Emory, in 1982, I had many African American students stopping by my office. A colleague in the office next to mine, asked me why. I explained that since there are so few minority faculty, when a minority professor joins the campus, the students want to stop by and acknowledge his or her presence. It's an issue of pride. I also feel it is important to meet with all students. I have an open door policy--any student who wants to see me, can.

Tell us about the LSU Chemistry Department.

When I first came to this department, there had never been more than 3 African Americans in chemistry at one time. Today, out of a total of 115 students, we have more than 30 African Americans working on their Ph.D.s in chemistry.

Why is that?

We have built a critical mass. Our recruiting is minimal. Our current students are spreading the word about our program. Thus, recruiting becomes self-sustaining. The only other department at LSU that has comparable numbers is the education department. When I arrived at LSU, there were two African-American students in the department; then four applied, and two of the four accepted. I brought in ten students, five of them African-Americans. That number has continued to increase. The faculty within this department are receptive. At the beginning, faculty needed coaching. Some assumed that the African American students might not be able to meet the challenge. Once the faculty worked with these students, they realized that these students have the same capabilities as other students. This department is producing excellent chemistry students. As an example, Proctor & Gamble conducted a nationwide search for six positions. They offered one of my students, who is African American, two of those six positions.

Louisiana is more than 30% African American. The number of students we're getting is in-line with the state's demographics. Also, students feel comfortable here. They have a supportive environment as well as many networking opportunities. For example, the students have formed a local chapter of NOBCHE (the National Organization of Black Chemists and Engineers).

A supportive structure is essential. This is something that

automatically exists for white males. For example, my brother, an engineer, returned to graduate school. Although he knew the answers in class, when it came time for the exam, he always scored lower than his performance in class reflected. He asked me why. I explained to him that more than likely there were study groups; he just wasn't being invited to them. He was excluded. Through perseverance, he became part of a study group.

Do you encourage students to go into academia?

When I find a student who would be good in academics, I do encourage them to go in that direction. In my opinion, you aren't going to change the fact that many students go into industry. Most white males go into industry. You'll only find a small portion of minority students going into academia. Many of my students look at me and comment that if they have to work as hard as I do-they are not interested. I need to do a better job of making students realize that what I do is fun. They don't think of my job in that way.

Were you surprised when you won the Presidential Award for Excellence in Science, Mathe-matics and Engineering Mentoring?

Yes. I didn't even know that my students had nominated me for this award! The young woman I mentioned earlier, wrote a letter for me. She wrote how I was able to show her a way when she thought there was no other way. I think that says it all.

Thank you, Dr. Warner.

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Project Talent Flow:

The Non-SEM Field Choices of Black and Latino Undergraduates With the Aptitude for Science, Engineering, and Mathematics Careers

By Beatriz Chu Clewell and Shirley Vining Brown

This paper presents findings from the Alfred T. Sloan Foundation's Project Talent Flow, a research effort aimed at determining why black and Latino students with the aptitude to succeed in SEM majors are not pursuing careers in these fields. Talent Flow was initiated in response to growing concern about declining interest in scientific disciplines among students as well as the failure of major initiatives to attract minorities into these fields.

Research for this project was guided by three major goals and several specific objectives. The first goal was to contribute information to the SEM literature about high ability minority students who have previously been overlooked as research subjects. Second, we wanted to identify the critical factors that could increase the number of underrepresented minorities in SEM careers. Our third goal was to use empirical research to inform educational policy makers. In order to achieve these goals, our objectives were to talk with high- ability black and Latino students and learn about critical experiences that influenced their choices of non-SEM degree majors; examine race/ethnic group and gender differences among these students; and discover which factors might influence high ability minority students to seriously consider SEM majors.

Although surprisingly little re-search on high ability minority students can be found in SEM literature, certain studies have informed our efforts. These studies indicate that students' interest in a subject precedes career choices, and that to become a scientist or engineer students' interest must be maintained starting from the middle school years. Unfortunately, however, recent trends show that interest in SEM subjects is dwindling among pre-college students, and fewer college students are expressing an interest in scientific fields of study. As a result, enrollment rates in college-level science and engineering programs are declining.

Minority students, who are at least as likely as white students to be interested in SEM career fields, are especially

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underrepresented in scientific careers and SEM college programs. Interest-ingly, this underrepresentation seems to occur at least in part because many minority students' aspirations shift from SEM to non-SEM career fields after entering college. Thus one guiding question for our research was: What happens before or during college that diverts the interests of black and Latino students away from SEM fields?

A series of studies reflecting two general viewpoints suggest possible answers to this question. This first viewpoint has to do with structural factors; in other words, the field choices of minorities result from structural barriers in the social system of SEM education. Possible structural factors include issues related to preparation, curriculum, instruction, advising, and the availability of faculty role models and mentors. Adherents to this viewpoint suggest that if structural barriers are removed, minority representation in SEM fields will increase. The second general viewpoint cites psychosocial factors, meaning that decisions about choices of degree majors are internal to students. In this perspective, factors such as career aspirations, the need for achievement, the need for affiliation and encouragement, perceptions of ability, perceived utility of careers, family and career issues, and cultural orientations toward SEM fields have the largest influence on students' decision-making processes.

A series of steps was taken to select appropriate interview sites for a detailed examination of these possible factors. Initially, five institutions with high concentrations of black and Latino students in the social sciences, business, or psychology were identified. Of these five institutions, two were located in the Far West and one each in the Northeast, Southwest, and Midwest. After a series of site visits, we narrowed our sites to three selective, public Research I universities (Far West, Northeast, and Southwest). Black and Latino nonscience majors were then selected as interview candidates using purposive sampling. The criteria considered in this process were: citizenship status, gender, declared majors in non-SEM fields, and a minimum of 550 on the SAT I test. These restrictions produced 190 interview candidates at the Northeast institution, 547 at the Far West institution, and 650 at the Southwest institution. Once responses were collected to a survey questionnaire mailing, these numbers were narrowed down to a total of 135 black and Latino students from all three sites, 86% of whom had SAT I math scores at 600 or above.

After training with a senior researcher at the American Institutes for Research, in the fall of 1996, researchers conducted in-depth, one-on-one interviews with the selected 135 black and Latino students using the critical incident technique. This technique involves collecting information on significant incidents from knowledgeable individuals who are qualified to evaluate the relationship between what happened (the behavior) and the outcome of that event. Respondents

were asked questions regarding their reasons for choosing current degree majors, experiences related to consideration of SEM majors, course-taking patterns, instructional experiences, interactions with working professionals in SEM, and interactions with peers in SEM fields. After collecting a sufficient number of incidents (1,871, of which 1,738 were usable), researchers then used an inductive classification procedure to build an inclusive picture of factors in career choice decisions. Finally, interviews were also conducted with 18 administrators and faculty members in science/ engineering and non-science/ engineering majors at the three institutions.

Due to its specific focus this study does have some limitations. First, students interviewed here are not a random sample of all high-achieving black and Latino undergraduate non-SEM degree majors, and thus cannot be generalized to this population. Second, this study omits students who switched from SEM majors to non-SEM degree majors and/or those who chose to remain in SEM degree majors.

Of the students interviewed, 81% are 21 years old or younger. Latino students comprised slightly over one-half of the sample and women outnumbered male subjects by a ratio of 1.45 to one. About 64.4 and 60.7%, respectively, of respondents' mothers and fathers are college educated; slightly more fathers than mothers are employed in professional occupations. In terms of major areas, the greatest proportion of students are majoring in the social sciences and professions (28.9% of blacks and 26.7% of Latinos), followed by the humanities (17.0%), liberal arts/other (14.1%), and psychology (13.3%). The great majority of students had taken four or more high school mathematics courses (86%), and nearly two-thirds took four or more science courses. Most rank themselves in the top 25% or higher in their college class.

In terms of race and gender, some significant differences were identified. First, a much higher proportion of fathers of Latino students had less than a high school education (21.9%) as compared to fathers of black students (2.4%). This difference also exists between mothers of students; more than 70% of mothers of black students had earned undergraduate and graduate degrees as opposed to roughly one-half of Latino students' mothers. Furthermore, higher percentages of mothers of Latino students never worked or do not work outside of the home. In terms of majors, over three times as many Latino students than black students majored in the social sciences.

Our analysis of the skills and preparation of the students interviewed show that both GPA and test scores are equal to or higher than the overall means at their respective universities. Their SAT I test scores also compare favorably to the national mean, outscoring it by 207 points in math and 55 points in verbal. Thus the Talent Flow students appear to

be well prepared to handle college-level SEM courses, and have skills in mathematics and verbal areas that are higher than both university-level and national averages.

Eight major domains of factors affecting the choices of non-SEM degree fields emerged from our analysis using the critical incident technique. These include: people-related influences; course-related influences; respondent-related influences; career-related influences; media influences; social issues influences; extracurricular activities; and other influences. Among these, the major factors are related to teaching practices and course or curriculum issues (structural) as well as teacher interest and encouragement, family influences, and student perceptions of ability (psychosocial). We conclude from our identification of these domains that an explanation for the failure of high ability minority students to pursue SEM majors lies in factors that represent BOTH structural and psychosocial viewpoints.

Our investigation of these domains also clarifies the issue of explaining why minority students turn away from SEM fields after entering college. For instance, although many students made positive comments about high school SEM teachers, the majority reacted negatively to the poor quality of college level instruction. Students who enjoyed SEM courses in high school were also alienated by the restrictiveness and difficulty of college-level SEM work. In contrast, many students were impressed with their non-SEM college experiences. Similarly, while students felt encouraged by non-SEM teachers and professors to enter non-SEM fields, they sensed that SEM professors did not offer similar encouragement.

Other psychosocial factors also play a role in students' decisions to choose non-SEM major fields. Students generally did not feel pressured by family members to major in SEM fields, and in some cases family members actively supported students' non-SEM majors. Students also perceived themselves as being less talented in SEM fields, and thus chose non-SEM areas to escape becoming what they viewed as below average.

There are several implications of this study for policy and practice in the areas of instruction, curriculum, student support, and general science and technology literacy. In terms of the policy and practice of instruction, we have found that the effort and expense involved in developing intervention programs to attract minority students will yield little return unless the teaching of SEM subjects undergoes reform, especially at the college level. These reforms should include: modification of doctoral training programs; development/modification of in-service training training materials; development of teaching standards that include indicators of successful teaching skills; and development/modification of recruitment and hiring policies to identify faculty and TAs who have successful teaching

abilities. In terms of curriculum policy, we recommend the implementation of hands-on activities that involve learning through doing; high school curriculum reform that would connect the course content of SEM disciplines to broader societal issues; and modified testing procedures in introductory SEM college courses that reflect fair and consistent grading standards. Student-related policy reform should include the establishment of Uri Treisman's workshop training model* as an intervention for undergraduate students and the initiation of advising system reforms that help students become more informed about studying SEM fields. Finally, general science and technology literacy reforms are needed in the form of informal television/news programming that highlights minority scientists as well as middle and high-school level emphasis by teachers and guidance counselors on the societal benefits of and opportunities in SEM fields.

Excerpted from Brown, Shirley V. and Clewell, Beatriz C. *Project Talent Flow: The Non-SEM Field Choices of Black and Latino Undergraduates With the Aptitude for Science, Engineering, and Mathematics Careers*. Final report to the Alfred P. Sloan Foundation, January 1998.

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*Treisman, Uri. "Studying Students Studying Calculus: A look at the lives of minority mathematics students in college." College Mathematics Journal, Vol. 23, No. 5, Nov. 1992, pp. 362-372.

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Shirley Vining Brown "Citizen Scientist"

by Shirley M. Malcom
Head, Directorate for Education and Human Resources Programs

In 1975 I helped organize an AAAS conference on minority women in science and engineering. Supported by the National Science Foundation, that conference and its resulting report, The Double Bind: The Price of Being a Minority Woman in Science, helped change the nature of the discussion about the situation of "twofers." Many had contended that in the age of affirmative action those of us who were "twofers" had a real advantage in the job market, given our simultaneous membership in two "protected classes."

But assertions are one thing and the facts are another. The small fraction of minority females who completed degrees in science, mathematics, and engineering at the highest levels suggested that factors affecting their participation and their workforce outcomes were anything but simplistic.

Shirley Vining Brown recognized this complexity and was among those researchers who applied their skills to untangling this story. In the process she became a colleague, friend, and co-conspirator.

We shared passions, platforms, and geography (since for a while both of us lived in Columbia, Maryland). Shirley Vining Brown was not only interested in the interplay of social and educational environments as scholarly work. She was interested in recognizing and addressing the effects they had on children directly, especially issues related to minority student underachievement. As a resident of Howard County she organized tutoring programs in her neighborhood to help

Ann Williams

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African-American children realize their full potential. I still remember the day when we went together to see the superintendent of our county schools to address how the school system could become a partner or provide assistance to this community- based effort.

With her death in late 1998 we have lost a vibrant voice, but her work lives on. As for the studies she didn't get a chance to complete, it is left to the rest of us who've shared her passion, her platforms, and her work. Shirley indeed thought globally and acted locally, setting an example of "citizen scientist" that the rest of us can follow.

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July 1999

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A Message From Yolanda S. George

In late October of 1998, the NSF Minority Graduate Education (MGE) program awarded eight universities nearly $2.5 million each to significantly increase the number of African American, Hispanic, and Native American students receiving SME doctoral degrees. Also, as part of this initiative, AAAS and the Commission of Professionals in Science and Technology (CPST) received a three-year research award of $450,000. We will identify and disseminate factors that affect these students' underrepresentation in SME as well as the successful strategies that lead to their increased representation in science, mathematics, and engineering doctoral programs and careers, in particular the professoriate.

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

As part of our study, we are pleased to present the inaugural issue of our research newsletter, *Making Strides*. Each issue will feature an MGE research article; a profile of a minority SME professor; a hot topic question; a featured project; data charts from CPST; and information on grants and research opportunities.

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About Our Icon

For our first issue, we asked Shirley M. Malcom, Head of the AAAS Directorate for Education and Human Resources Programs, to explain our icon.

AAAS staff have tried, over the years, to convey symbolically a representation of the idea of structural reform in colleges and universities to better support SME minority students. This triangle was introduced in the 1991 AAAS *Investing in Human Potential* (IHP) as an elaboration of this notion of the evolution of program activity toward structural reform. We envisioned that projects would give way to programs and incorporation of practices that support the achievement of all students in science, mathematics, and engineering. We saw this evolution in the many schools we visited in the IHP study. Two other basic ideas embedded in this symbol are the movement form the work of the individual faculty or staff member who is inspired by passion and personal commitment to the formation of a community that cares and supports it sudents--within a college, a department, and ultimately the entire university.; and the movement from marginalized soft money efforts to support SME achievement, to the expenditure of regular hard dollars. As we *make strides* toward the top of this triangle, we learn from each other what works, under what circumstances, and to what end.

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