



**Research  
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Graduate  
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**FROM THE EDITORS**

Each issue of *Making Strides* features a profile on an institution that received an NSF Alliances for Graduate Education and the Professoriate (AGEP) award. This month we are pleased to feature-on this page-an article on the AGEP program by Dr. Roosevelt Johnson, our NSF program office. Anne Donnelly, Co-Principal Investigator of the AGEP Program at the University of Florida, graciously shares a write-up on her institution's AGEP work.

Theresa Smith, with the Center for Institutional Data Exchange and Analysis, University of Oklahoma, describes their NSF-funded retention database. With respect to minority graduate student data, our lead article by John Tsapogas of the National Science Foundation, outlines current data and trends on graduate student data in the sciences. And, M.B. McAfee focuses on the educational experiences of American Indians.

**LET US KNOW WHAT YOU THINK**

Please continue to send us your comments, feedback and inquiries. Afterall, the goal of this newsletter is serve the needs of its readers. If you are interested in submitting a research article, please contact Ginny Van Horne at [gvanhorn@aaas.org](mailto:gvanhorn@aaas.org). For further information on our work, visit: <http://nsfagep.org>.

**ANNOUNCEMENTS**

**New Reports on AGEP Website**

Of note, two new reports have recently been posted on our website under the special reports section of our website.

- [LIMITED PROGRESS: THE STATUS OF HISPANIC AMERICANS IN SCIENCE AND ENGINEERING](#), is the second in a series of special reports on the status of underrepresented groups in science and engineering. Eleanor Babco, Executive Director of the Commission on Professionals in

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Science and Technology and Co-Pi to the MGE grant wrote this piece.

- [TRANSCENDING THE PLACES THAT HOLD US: PUBLIC POLICY AND PARTICIPATION IN SCIENCE](#), a paper presented by Daryl E. Chubin, Senior Policy Officer, National Science Board Office, NSF, at Workshop 2000: A Joint Conference of the American Association for the Advancement of Science, the Emerge Alliance, and the National Science Foundation in Atlanta, Georgia on February 24, 2000.

### **Fellowships from AAUW**

**Description:** These fellowships are awarded to women of outstanding academic ability who are citizens or permanent residents of the U. S. for full-time graduate study in designated fields where women's participation has been low. Eligible fields currently include mathematics, statistics, computer science, and engineering.

**Eligibility:** Excluding engineering, all fellowships are for the final year of the master's degree. Degree must be earned at the end of the fellowship year (July 1-June 30). Candidates for the master's in engineering are eligible for the first OR final year of their program. Fellowships are additionally available for the final year of the doctorate in engineering.

**Award amount:** \$5000-12,000 for masters and \$15,000 for doctoral fellowships.

**Deadlines:** Applications are available August 1-December 20 (master's) and August 1-November 1 (doctoral). The postmark deadlines for submission are November 15 for doctoral applications and January 10 for master's applications.

For information: contact the AAUW Educational Foundation, Department 159, P. O. Box 4030, Iowa City, IA 52243-4030; telephone 319-337-1716 ext. 159 or visit the website at <http://www.aauw.org>.



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**Managing**

**Are Minority Graduates with Recently Acquired Science and Engineering Degrees Continuing their Education after Graduation?**

*By John Tsapogas, Senior Analyst, National Science Foundation, Directorate for Social, Behavioral, and Economic Sciences, Division of Science Resources Studies*

The 1990s was a very important decade for minority participation in science and engineering. An increasing number of underrepresented minorities were attending college and obtaining undergraduate degrees in science and engineering. But what were these graduates doing after they received their bachelor's degrees? Were they continuing their education by enrolling in graduate school after obtaining their bachelor's or master's degrees? If they had not continued their graduate education, what were their plans for the future? Were they more likely or less likely to attend graduate school in the future?

When analyzing college graduates with science and engineering degrees and their propensity to continue their education by enrolling in graduate school it is also important to understand the changes in the labor markets, the overall economy, and the large impact these conditions have on the decisions graduates make regarding their careers.

During a period of large economic expansion and job growth such as the mid to late 1990s, college graduates in general are more likely to choose to enter the workforce and less likely to continue their education by enrolling in graduate school. If they choose to continue their education they are also more likely to do it on a part-time basis. During periods of economic slowdowns we usually see a reverse trend. Graduates are more likely during those periods to enter graduate school.

What happened in the 1990s to graduates with S&E degrees--especially minority graduates? Looking at data\* from the National Science Foundation's National Survey of

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Recent College Graduates we can examine the status of recent graduate participation for continuing their graduate education and the relative differences for each of the racial/ethnic categories. We define enrollment in graduate school very loosely as simply "taking courses". We chose this definition because it allows us to include all graduates regardless of their commitment to an advanced degree. By doing so we include those graduates who are working full-time and taking courses on a part-time basis together with graduates who are not employed and pursuing graduate study on a full time basis. We include graduates enrolled in a degree program as well as those taking courses for work-related reasons. ([See Table 1](#))

Despite an improvement in the economy and increases in overall job growth we saw an increase in graduate school enrollments for S&E graduates that recently received bachelor's degrees. The percent of all recent science and engineering (S&E) bachelor's graduates that enrolled in graduate school between 1993 and 1997 increased slightly from 47.4 percent to 48.2 percent.

Asians with S&E bachelor's degrees were the most likely to attend graduate school and had the largest increase in graduate participation-55.5 percent of Asians entered graduate study in 1993 increasing to 60.7 percent in 1997. Hispanic S&E bachelor's recipients were the next most likely group to enter graduate school. The percent of Hispanics enrolled in graduate study increased from 51.3 percent in 1993 to 51.5 percent in 1997. Blacks showed a significant percentage increase in enrolling in graduate school after receiving their bachelor's degree, albeit, from a smaller base. They increased from 45.3 percent of the 53,799 1991 and 1992 bachelor's degree recipients to 49 percent of the 48,482 1995 and 1996 bachelor's degree recipients. Whites as a group attended graduate school at a lower rate than all other racial/ethnic groups and the percent of white graduates that attended graduate school remained about the same.

The pattern for S&E master's degree holders showed a somewhat different pattern during the period. The overall number of recent S&E master's recipients continuing their graduate study decreased nominally from 41.7 percent to 41.3 percent. Whites and Blacks increased their rates of enrollment in graduate study. Whites increased from 39.8 percent to 40.1 percent and Blacks increased significantly from 40.3 percent in 1993 to 45.6 percent in 1997. Hispanics and Asians with recent S&E master's degrees showed a decrease in their rate of enrollment in graduate school. Hispanics decreased significantly from 54.2 percent in 1993 to 40.9 percent in 1997 while Asians decreased from 47.4 percent in 1993 to 44.5 percent in 1997.

It is unclear why Hispanic and Asian participation in graduate study after attainment of a master's degree has decreased during the period. It is conceivable that Asian and Hispanic graduates are less willing to give up an opportunity for higher paying jobs that the current economy is providing them. If this is true why are Blacks and Whites not also responding to these changes? The answer may lie in

the fact that within Blacks and Whites there are large numbers of graduates with degrees in fields like the social sciences and psychology, fields where the doctorate is the terminal degree.

Graduates that did not attend graduate school after receiving their degrees in 1993 and 1997 were asked how likely it was for them to enroll in graduate school at some time in the future. They were asked to respond whether it was very likely, somewhat likely, or unlikely to enroll in college at some point in the future. As a group graduates who reported that it was very likely that they would enroll at some point in the future decreased from 68.9 percent in 1993 to 63.9 percent in 1997. Whites and Blacks accounted for all of the decrease while Hispanics and Asians reported an increase in the percent very likely to enroll in graduate school at some time in the future. Graduates as a whole reported that they are somewhat likely to attend graduate school in the future with Whites and Blacks showing an increase in the percent reporting "somewhat likely" between 1993 and 1997 and Hispanics and Asians showing a decrease. Somewhat surprising was the increase in the number of graduates who reported that they are very unlikely to attend graduate school between 1993 and 1997. The percent of graduates that reported future attendance in graduate school as very unlikely rose from 7 percent in 1993 to 8.7 percent in 1997. All racial/ethnic groups showed increases except for Hispanics who reported a decrease in the number of graduates that were very unlikely to attend graduate school. Although the data demonstrate that large numbers of graduates with bachelor's and master's degrees intend to continue their graduate studies, a small and increasing number of Whites, Asians, and Blacks reported that they are very unlikely to do so. ([See Table 2](#))

These data have provided us with a good understanding of what occurred in the 1990s and a view towards the likelihood of underrepresented minority participation in S&E graduate study in the future. The data show that during the 1990s some groups, such as Blacks with S&E bachelor's and master's degrees have performed well in terms of their participation in continuing graduate studies and others such as Hispanics with S&E master's degrees showed a weaker than expected performance in graduate school enrollment. The data also show that the numbers of graduates reporting that it is very unlikely that they will attend graduate school is increasing. These indicators provide us with valuable information for charting the future course of minority participation in S&E graduate studies and may give us some insight on how much needs to be done to increase minority participation in science and engineering.

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**My Vision of an AGEP Community**

*By Roosevelt Johnson, AGEP Program Director, National Science Foundation*

The Minority Graduate Education (MGE) program was renamed the Alliances for Graduate Education and the Professoriate (AGEP) program in December, 1999. The name reflects two very important areas of evolution in the MGE program: administrative strategy and objectives.

The Louis Stokes Alliances for Minority Participation (LSAMP) program at NSF has had considerable success in increasing the number of underrepresented minority students receiving baccalaureate degrees in Science, Math and Engineering (SME) fields. During a December, 1999 meeting of MGE Principal Investigators, several MGE projects voluntarily formed institutional alliances to more cooperatively accomplish the overall goals of the MGE program. The evolution of MGE to AGEP, consequently, reflects NSF's belief that comprehensive, coordinated institutional partnership strategies similar to those in the LSAMP program will be more successful than the single institution funding strategies of the past at significantly increasing the number of underrepresented minorities receiving doctoral degrees in SME fields. Additionally, the program will now more proactively develop strategies and direct resources to the goal of increasing the number of underrepresented minorities prepared for faculty positions in SME departments.

The implementation of an alliance-based strategy affords tremendous opportunities to develop increased synergy among AGEP/MGE projects. As the newly appointed AGEP Program Director, I envision the effective linking of AGEP/MGE projects with other federally funded projects (e.g., LSAMP) on regional and national levels to create a dynamic community of institutions working together to identify and nurture minority talent in SME areas. The goal is to develop more effective linkages that will offer minority students increased opportunity to progress through

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the educational continuum from undergraduate through graduate school and into faculty positions. I consider the establishment of that sense of community among AGEP projects and other federally funded projects to be one of my most important administrative challenges.

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**An Interview with Dr. Hector Flores**

*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.

This month I had the opportunity to chat with Dr. Hector Flores, Professor of Plant Pathology and Biotechnology at the Pennsylvania State University, University Park campus. Currently, he is on leave to the National Science Foundation as a Visiting Scientist/Program Director in the Molecular and Cell Biology Division. Dr. Flores received his B.S. in Biology in



1974 from the Universidad Nacional Mayor de San Marcos in Lima, Peru, and an M.S. in Horticulture in 1977 from the University of Puerto Rico. He received his Ph.D. in Biology, "Studies on the Physiology and Biochemistry of Polyamines in Higher Plants" in 1983 from Yale University and joined Penn State in 1988. Throughout his career, he has developed an active international and national program-balancing basic and applied research-in plant biology. With more than 85 technical papers published, Dr. Flores' research projects center around the metabolism and biochemistry of biologically active compounds produced in plant roots, and the uses of plants for nutrition, pharmaceutical and agrichemical applications. He has trained a number of undergraduate and graduate students from the United States Department of Agriculture's (USDA) Minority Apprenticeships Program, the Department of Education's Summer Minority Research Opportunities Program, the Howard Hughes Summer Institutes Program and the USDA's National Needs

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Fellowship, as well as advised local high school science students from the Pennsylvania Governor's School. Of note, Dr. Flores has developed innovative approaches to biology, and in particular, science teaching. Since 1992 he has hosted visiting scientists and advised a number of graduate students from around the world and served as the Director of the Science, Technology and Society Program at Penn State from 1995-1998. Most recently, he began an international initiative for research and training in Latin America, focusing on Andean root and tuber crops. Dr. Flores research has been funded by the National Science Foundation, USDA and the McKnight Foundation, among others.

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

I imagine because I grew up in a household that encouraged and fostered an interest in science. My father was a doctor and my mother a housewife. From the time I was a child, I was surrounded by science-I read stories about Louis Pasteur and Galileo. I received my first microscope at the age of ten! My love of science simply took on a life of its own. I knew that I wanted to do something in biology.

I did well in mathematics and science. By high school, I knew I would go to college to study biology, but not medicine. I attended the Universidad Nacional Mayor de San Marcos in Lima, Peru and graduated in 1974 with a B.S. in biology. In Peru, obtaining a Bachelor's of Science in biology is a five-year commitment. One must take all of the biology courses, thus getting a very broad background. After graduation, I worked at the university as an instructor in biology and molecular biology through 1975. In addition, I selected a short research topic and gathered bibliographic cards while I waited for a position opening in a lab at the university. During this time-it was 1973-I met Javier Zapata, a plant biologist who had just returned from Kansas with a Master's degree in plant biochemistry. He offered me a position in his lab at the Universidad Nacional de San Marcos and I began working for him.

**Were your experiences in graduate school positive?**

I had a wonderful time in graduate school. I made great friends, had supportive and warm classes as well as an abundance of lab materials. My lab was like a big, diverse family. Surprisingly, for me, the greatest challenges I have faced as a member of an underrepresented group have occurred in recent years-as a faculty member.

**What next?**

I knew I wanted to get my doctorate. Because Peru does not offer any Ph.D. programs in biology, I moved to Puerto Rico and applied to the University of Puerto Rico, Mayaguez for a training fellowship in nuclear techniques in biology. From 1975-1977 I worked as both a teaching assistant and research assistant on the

Rhizobium Project with Dr. Carlos Fierro, a professor from Chile. I was also interested in getting a Master's in horticulture. Under my mentor, Dr. Carlos Fierro, I investigated the micropropagation of plants and wrote a thesis entitled *In vitro Culture and Radiation Studies of African Violet Saintpaulia ionantha Wendl.* I obtained my Master's from the University of Puerto Rico in 1977 and made the jump to the United States that same year by taking a horticulture fellowship at Rutgers State University.

My goal was to attend Yale University, but I wasn't immediately accepted. While at Rutgers, I wrote to Dr. Arthur Galston, a member of the biology department at Yale, and made a point to visit him. I was persistent! In 1978 I was accepted. From 1978 to 1980 I worked as a teaching fellow in the department of biology; from 1980-1982 as a research assistant. Dr. Galston was an admirable mentor. In fact, I consider him to be a good friend. He was encouraging and inspiring-challenging me to remain open and curious to a variety of topics. This was a perfect match with my personality since I tend to concentrate on many topics, rather than specifically focusing on only one topic at a time.

### **And, after Yale?**

I graduated from Yale in 1983 with a Ph.D. in biology. At that time I mostly wanted to do lab work and to remain in academia. Dr. Galston recommended that I first get some experience in industry. It was the early 1980's and I was quite fortunate that many oil companies were hiring plant biologists to work in biotechnology. From 1983-1985 I worked as a postdoctoral research associate for the ARCO Plant Cell Research Institute in Dublin, California.

### **Why did you leave industry?**

After two years at ARCO, I was ready to move on and try something else. I thought about returning to Peru, but there were no job opportunities in my area of expertise. I applied to Louisiana State University, Baton Rouge, and was hired as an Assistant Professor in their Department of Plant Pathology and Crop Physiology and stayed there from 1985-1988. Unfortunately, support for my specific area of research declined rather quickly. A job search led me to Pennsylvania State University, University Park where I was hired as an Associate Professor in 1988.

I've been at Penn State for 12 years and was promoted to full professor in 1994. I took a leave of absence in October 1999 to work at the National Science Foundation as a Visiting Scientist/Program Director in the Molecular and Cellular Biology Division.

### **Tell us about your students.**

I work with both undergraduate and graduate students and have also made it a point to advise local high school science students. I firmly believe in mentoring and make it a priority to mentor and reach out to all students. My main goal is to stimulate my students' interest in their studies and to encourage initiative and risk-taking. I encourage my students to be risk-takers-to broaden their horizons as much as possible-just as my mentor, Dr. Galston, encouraged me to do.

My special academic love is interdisciplinary work. For example, I teach a class called Seeds of Change that integrates botany, chemistry, history and economics. In the class I use cooking as my method of demonstration. The students are charged with "deconstructing" things such as salads, rice, etc. Not only do we have fun, but we learn a new way of integrating several subject topics. I also teach a seminar called Science and Creativity that encourages students to build an historical and philosophical background of science.

The theme of diversity is in all of my work and teachings. All of us-students and faculty alike-need to be aware of what is outside of our fields. We must approach science in very broad terms. The importance of diversity parallels the importance of interdisciplinary work. We have basically exhausted the social and economic rationale for diversity. It is in our best interest to have a diverse group of scientists doing sciences. It increases choices; and, it fosters different ways of looking at things.

**It's clear you enjoy working with students, is that why you became a professor?**

Yes. Plus, I've always had the desire to make a difference in the minds of young people. I love teaching; I am passionate about it. I also think I can provide alternative examples for doing research. My style is to explore-to open up new avenues of inquiry. The thought of doing the same thing, forever, is boring! I think there is a value and a need for this kind of approach to research.

**What about your own personal experiences and views on diversity?**

I have had some interesting experiences. In my native country of Peru, I am not considered an underrepresented minority. I lived a very typical, middle class existence. In fact, I had many advantages because I spoke English fluently. Yet, in this country, I am part of an underrepresented group. There seems to be an underlying assumption in the U.S. that if you belong to an underrepresented group, by default, you are underprivileged. Personally, I can't even presume to identify with this. I cannot presume to understand the hardships endured by underprivileged groups, but I can identify with their plight and their effort to be the best they can be.

It is everyone's responsibility to be proactive in minority student recruiting and mentoring. All of us need to confront the cultural gap and do our best to mentor and recruit students from underrepresented groups. That being said, I also believe that we should mentor all types of students and that students should be willing to approach faculty who do not look like them as potential mentors. This increases diversity and integration-allowing for the broadening of horizons. As an analogy, think of grafting. In my case, placing an Hispanic bud on a European rootstock, ending up with the best of both. Both student and mentor learn from one another. This is an example of promoting diversity in an integrated fashion.

**Tell us about your department at Penn State.**

Neither my department nor program are very diverse. I am the only Hispanic member of a department of roughly 25 faculty; three of the 25 are female. There are

no African Americans in my department. I'm also the only minority faculty member in our plant physiology interdisciplinary program, which has about 40 faculty members. I'd say that overall, out of close to 4,000 faculty at Penn State, perhaps 49 are Hispanic. None are in any position of administrative influence.

As far as students, I've taught a very diverse group of undergraduates. It's been very difficult, however, to recruit underrepresented minorities into the graduate program. Not only is the recruiting pool rather small, some faculty may find it burdensome to recruit. And, overall, our graduate program was having a rather difficult time recruiting top students. Period. Using my own grant money, I've been proactive in recruiting students on my own through visiting schools such as Cal State (Northridge and Los Angeles) and the University of Puerto Rico. For example, last year I recruited our very first Hispanic student to the plant physiology program!

### **What type of advice do you give to your students?**

My Ph.D. students always ask for advice so I always encourage them to be proactive-to be a risk-taker. Ultimately, this is what will make a difference. And, I always tell them that there is no right or wrong answer as far as career choice. Some students are very entrepreneurial and would be happy and do quite well in industry. Others would have a better fit in academia.

**Thank you, Dr. Flores.**

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**From Their Voices: American Indians In Higher Education And The Phenomenon Of Stepping Out**

*By: Mary E. McAfee, Ph.D., Research Associate, Ethnography and Evaluation Research, Bureau of Sociological Research, University of Colorado*

Colleges, universities, government agencies, and foundations are striving to recruit and retain numbers of underrepresented minority baccalaureate and graduate degree recipients in natural and physical sciences, engineering, and mathematics (SEM). To do so successfully, we must understand and build on the experiences of American Indians in higher education. American Indians were queried about their experiences as SEM majors in a broad-based qualitative study (McAfee, 1997). The phenomenon of "[stepping out](#)"\* emerged as a conceptual framework to describe, explain, and predict the college-going patterns of American Indians in SEM majors. The model generates general and specific recommendations for improving retention rates of American Indians in undergraduate SEM programs.

**Status of American Indians in Undergraduate SEM Majors**

The National Science Foundation report, *Women, Minorities, and Persons with Disabilities in Science and Engineering: 1998*, includes a multitude of statistics that verify the underrepresented status of American Indians, African Americans, and Hispanics in SEM fields in higher education and employment. The small size, as well as identification issues, of the American Indian population (2.5 million or about .9% of the US population) raises serious questions about the reliability and validity of statistics collected and reported to determine characteristics of this population. Inconsistencies of statistical measurement by institutions of higher education complicate the picture. The lack of uniformity in reporting statistics was repeatedly noted at Workshop 2000: A National Dialogue to Increase Minority Participation in SEM, a joint

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conference of the American Association for the Advancement of Science, the EMERGE Alliance, chaired by the Georgia Institute of Technology and the National Science Foundation held in February, 2000 in Atlanta, GA. Colleges, universities, government agencies, and funding entities generally measure persistence and graduation rates by four-, five-, or six-year cohorts. Research about American Indians in higher education revealed other cohort measures that included persistence cohorts and transfer cohorts.

Statistical reports leading to analysis of the pipeline, or numbers of American Indians who are eligible to participate in higher education, and SEM majors in particular, are not easy to produce. However, it appears that the following observation made by William Tierney in 1992 remains true today. He suggested that if 100 students [American Indian] enter the ninth grade, 60 of them will graduate from high school and about 20 will enter a postsecondary institutions. Of those 20 students about three will receive a four-year degree (p.9). This represents a 15% pipeline retention rate and an 85% attrition rate at the postsecondary level. Combine this low retention rate and examination of the numbers of American Indians in SEM majors and numerical description becomes practically meaningless. However, examination of their voices and stories yields rich data that begin to explain and predict their paths in higher education.

## **Research Process**

Research data consisted of audio-taped interviews with 76 participants. Twenty-seven were step-outs (American Indians who had been enrolled in SEM and business undergraduate programs in four-year institutions and were no longer in school with no immediate plans to return) and 16 were graduates (American Indians who had earned baccalaureate degrees in SEM and business). Thirty-three faculty and administrators were also interviewed. Participants came from nine colleges and universities in eight states in the plains, northwest, and southwest regions of the country. Participants are affiliated with 29 tribes, bands, and pueblos. Nine reservations and pueblos were visited during the course of research.

Interviews lasted from 45 minutes to more than four hours. Word-for-word transcriptions of interviews were produced to facilitate data analysis and interpretation using the tenets of grounded theory (Glaser & Strauss, 1967). Information about recruitment, enrollment, and graduation figures from institutions in the study were examined to supplement the interview process.

There have been a variety of models of college attendance of underrepresented minorities offered by other writers (Bean, 1982, Belgarde, 1992, Richardson and Skinner, 1991, and Tinto, 1975, 1987). Generally these models utilized four-, five-, and six-year cohorts to measure successful degree completion rates by American Indians and other underrepresented minorities. Available models appear to be linear

in their presentation and the outcome is often described by phrases such as "drop-out," "stop-out", or "leaving decision."

### **The Phenomenon of Stepping Out**

"During my years at the university I saw that many Indian students would be enrolled for a while and then leave. Maybe after they got more money or took classes at a community college they would come back and then maybe for other reasons they would leave again. That's basically what I did, sort of step into and out of college more than once."

The phenomenon of stepping out is evident in the words of this American Indian male who took 12 years to earn a baccalaureate degree in electrical engineering after attending four different institutions of higher education, including a stint at a community college. Given the lack of uniformity in reporting retention rates, it is difficult to know how this graduate was counted along his path towards earning a bachelor's degree.

The voices and stories of American Indians who had left SEM programs, graduates in SEM majors, and faculty and administrators who participated in the research were in agreement that moving in and out of colleges and universities is a typical attendance pattern of American Indians. The metaphor "stepping stone" comes from the words of participants to indicate progress towards graduation. Using a metaphor transcends local and specific circumstances, making the phenomenon applicable to other underrepresented ethnic groups in colleges and universities across the country.

The model ([See Figure 1](#)) of the phenomenon of stepping out that emerged from the research has several attributes that are different from the previously noted models of student attrition or college attendance.

- The outcome is framed in terms of successful completion of a degree.
- The dynamic nature of moving into, out of and back into higher education is evident.
- The model suggests the notion of progressive discovery as a way to identify, explain, predict, and support this college-going pattern.

Each stepping stone is identified with positive factors that kept students in school or brought them back into higher education, and with negative factors that served to pull them out and kept them disengaged from higher education.

Connections are made among the characteristics of the stepping stones, however, no particular stepping stone is singularly necessary and sufficient for the participants to remain in school. The arrow that traverses the middle of the model illustrates the fact that for some American Indians in SEM majors there is not a stepping-out period.

It is significant to note that in this research 37% of the step-outs talked about experiences that were seen by them as stepping stones towards attaining a four-year degree. In marked contrast, 68% of the graduates described circumstances that were directly described as stepping stones or interpreted in terms of stepping stones

which contributed to their persistence to graduation.

The concept of progressive discovery can be described as the process of gaining personal knowledge in the physical, mental, emotional, and spiritual aspects of life in order to find and maintain the necessary focus for completing undergraduate degrees in SEM majors. Progressive discovery is illustrated in the following remark made by a female graduate in environmental science who had attended two community colleges and two four-year institutions in the course of the ten years it took to earn her degree.

"It seems like every time I went back to school I was clearer about what I wanted to do. It was hard though, because every time I went back my life was more complicated with a bigger family and more debt and less money. But I always felt like I knew myself better. Finally I got a good hold of what I wanted to do so I just went for it."

Progressive discovery also suggests that change occurs in the institutions during the stepping-out time as highlighted by these words from a director of American Indian support services.

"Institutional change is slow and ponderous, no doubt about that. But there has been more attention given to the minority advocacy offices here recently. For returning Indian students there is a broader array of services available than even two or three years ago. Like our tutoring program is better than even just last semester because of a new grant which has allowed us to hire more tutors, especially in math, chemistry, and physics."

### **Giving Voice to the Phenomenon of Stepping Out**

Among all participants in the study, eight stepping stones emerged as significant elements in the experiences of American Indians in higher education: cultural identity, academic preparation, financial resources, motivation, family support, academic performance, alcohol and drug use, and institutional interface. Of the eight stepping stones, cultural identity became a prominent factor with direct and indirect ties to other stepping stones. Participant voices and stories provide insight into the importance of maintaining strong bonds with traditional tribal heritage. It is striking to note that of the step-outs, 22% perceived themselves to have strong cultural identity while 50% of the graduates identified strongly with their cultural heritage. Two illustrative quotes follow. The first words are those of a female graduate in computer science whose time in and out of higher education spanned eight years and three universities.

"I know where I come from. I know my background. Nobody needs to remind me. I brought my cultural heritage to school with me. I figured out that I can't really lose what is back home. This knowledge kept me grounded in my aspirations to finish school."

Conversely, the words of this step-out indicate that having weak cultural identity played a role in her decision to step away from higher education.

"My parents grew up in a time when they were brain-washed, you know.

They were the people who were sent away to schools where they were punished for talking their language and practicing their traditions. I guess they wanted to protect me and my sisters so we never learned any traditional stuff. Now me and my kids have moved back home to learn the Indian way. I figure I can put my education on hold while my kids grow up."

An administrator who worked closely with American Indian students at a large university related the importance of cultural identity to persistence in four-year SEM programs.

"Students have to learn to live in two worlds. They need to remember they are part of a community where cooperation, family, and generosity are highly valued but when they get to the university they have to conform to the predominate culture and be competitive and become somewhat self-centered, particularly in science classes, it seems to me. For an Indian who is just learning about their traditional heritage and becoming identified with their tribal heritage, it's hard to find their way in two worlds."

Family support was a pervasive force in persistence towards achieving a baccalaureate degree and emerged as an element in the phenomenon of stepping out. The lack of family support proved to be a barrier for the step-out who said:

"There was a real lack of support from my parents. I guess it was because nobody in my family went to college, so nobody knew what college life was like. They didn't have an appreciation for how it was to live in a dormitory and go to class where you are the only Indian. I couldn't count on them too much to help me."

Academic preparation was seen as a major factor in the longevity of American Indians in SEM majors at four-year institutions. An administrator explained an often-seen situation.

We have Indian students, whose grades in high school Algebra and Calculus are very high, yet on this campus we seem to move through their academic background in the first 3 or 4 weeks of class. By mid-semester they are lost and unless they get some help they are likely to fail those beginning math classes. Failing prerequisite math classes holds up their progress into a science or engineering major and often leads them to leaving school.

An electrical engineering graduate who related the following course of events underscored the value of summer bridge programs.

"I was fortunate to attend a five-week summer engineering program after my senior year in high school. I was able to become familiar with the campus and talk with faculty and counselors. Their attitude was that they would help me do whatever I needed to succeed. They helped me understand that there would be a social as well as an academic adjustment when I began college in the fall."

Financial resources emerged as one of the most critical factors associated with maintaining continued enrollment in SEM majors. This biological science graduate related a typical scenario.

"To begin with I had an academic scholarship from the tribe which lasted for a year. Plus I got some other tribal funding to make up the difference for my tuition. I was able to get this money for four years but then when I had to stretch my time in school past four years I had to depend on a Pell grant and I worked part-time. Finally, I had to resort to getting a student loan."

The administration of financial aid was a problem for the step-out who said these words, which were echoed by a number of other participants.

"Money has always been a problem for me and my family. We just don't have much, so even though I got a tribal scholarship it wasn't enough to pay for my first year in college. It was less than some other Indians got from their tribes. Plus the money from the tribe came late to the school and I kept getting bills with larger and larger late charges and finally I just couldn't pay them and I couldn't see how I would have money for the next semester, so I left."

Motivation derived from a number of sources emerged as a powerful influence on the path of American Indians in SEM majors. Many participants suggested words similar to this chemical engineering graduate.

- "To me, being motivated is about knowing what you want to do and having clear goals, then you can see progress."
- "Despite a strong sense of personal motivation, this step-out faced numerous obstacles to earning a degree in mathematics."
- "Kids in the valley where I grew up never gave much thought to making life different for themselves after high school. I am determined not to become another statistic, which is what I am right now, because I haven't been able to pull together the necessary money to stay in school. It's hard being a single mom without access to good day care for my kids."

Academic performance appeared to be closely aligned with academic preparation, particularly in mathematics. An undergraduate mathematics professor who had created an effective tutoring program summarized the connection with these words:

"It's pretty tough for some of these kids who got high grades in their high schools in math classes to come into college algebra or calculus and discover that college algebra is much different and harder than high school algebra. Students who don't get help right away often end up flunking basic math classes. Then they have to take lower level math in order to get up to speed. In the meantime, it may happen that they don't do well in other courses due to taking too many hours, poor study habits, partying too much or a host of other things. Often this results in academic probation and maybe academic suspension until they can improve grades in basic mathematics classes."

Alcohol and or/drug use intermingles with other stepping stones to complicate the progress American Indians make towards baccalaureate SEM degrees. The words of a step-out were reflected in other similar stories.

"Both my folks were alcoholic. I watched my father die, and my sister died in a car wreck that was related to alcohol. They say my brother committed

suicide when he was on drugs. It takes lots of effort to stay away from the stuff, but that is what I am determined to do, not only for myself, but for my kids too. And for right now I can't stay in school."

The stepping-stone of institutional interface revealed a wide range of programs to support American Indians in SEM majors. Words of praise for the innovative and helpful work of faculty and administrators were plentiful as step-outs and graduates related their experiences in colleges and universities. There were also voices and stories from all participants that were accurate illustrations of "official encouragement and institutional discouragement," a phrase coined by William Tierney (1992). Without realizing it, the civil engineering graduate whose words follow was explaining this phrase. Regrettably little had been offered to him at the university as he sought to gain balance in two worlds. It was during a time of stepping out that he became more grounded in his culture which resulted in clarified goals and sharpened motivation.

"I've seen students looking for acceptance in the fast-paced world of the university where acceptance is gauged heavily, it seems to me, on processes and disciplines full of facts and statistics. I know for myself that without a firm footing in my own culture, which I learned while I was out of school, the college experience can take you out of your realm, so to speak. Your life goes on a different path and renders you a stranger in a different way."

Analysis of the data revealed that no single participant spoke of all eight stepping stones. Indeed, it became clear that the interplay of cultural identity, financial resources, family support, and motivation proved fundamental for successful completion of SEM bachelor's degrees. The voices of graduates, faculty and administrators reflect that academic preparation, academic performance, drug and alcohol use, and institutional interface were less important stepping stones, provided that some combination of the first four were on a solid foundation.

## **Recommendations for Colleges, Universities, and Funding Agencies**

### **General recommendations:**

- Re-design policies and procedures to reflect the phenomenon of stepping out as the common mode of college attendance reflected by participants in the study;;
- Seek congruence of institutional actions with stated missions, goals, and objectives regarding recruitment and retention of diverse student populations. As more than one participant said, "Schools need to walk their talk."

### **Recommendations to accommodate the phenomenon of stepping out:**

- Examine and clarify communication between academic offices and student affairs offices to avoid one segment blaming the other for high attrition rates. There must be balanced input from these offices relative to responsibilities for retention efforts.
- Develop and practice a consistent definition of retention and attrition.

Statistical reporting within and across institutions of higher education and funding agencies must be uniform and must consider the reality of the phenomenon of stepping out as it relates to college attendance by American Indians and other minority populations.

### **Recommendations to mitigate the adverse consequences of the phenomenon of stepping out:**

- Create financial aid policies that assure a level of financial aid upon a student's return to school that corresponds to the amount with which a step-out began higher education.
- Develop and implement contractual agreements between students and schools regarding level of financial aid and conditions of stepping out and returning to school. Partnerships between individuals and institutions can be created to honor the spirit and intent of pursuing a four-year degree.

### **Recommendations to maximize the positive effects of stepping out:**

- Promote and support institutional contact with students who have stepped out. Student services should be funded to include periodic structured contact with students to assure, hasten, and nurture their return to school.
- Create and maintain collaborative relationships among institutions to increase graduation rates of American Indians and other minority students, recognizing that successful completion of a bachelor's degree is a shared goal among educational and funding organizations.

### **Implications of the Phenomenon of Stepping Out**

This research is significant for higher education because it highlights the necessity for administrators and faculty to understand this mode of college attendance of American Indians as colleges and universities work to recruit and retain these students in SEM majors. It is essential to understand that stepping out does not imply the departure from the broad system of higher education, indeed, it implies continuation at a later time. This research illustrates the need to grasp the interrelatedness of circumstances and that although the personal decision to leave school may hinge on one critical incident, the underlying factors are related to a variety of interactions with and among individuals, families, communities, groups, and organizations.

There is clear evidence of "official encouragement and institutional discouragement." American Indians and other ethnic minorities are encouraged to enroll in colleges and universities as these institutions strive to have student populations whose characteristics reflect the nation's changing demographics. However, without an understanding of institutional discouragement that fails to recognize and support the phenomenon of stepping out, there is a serious lack of systemic commitment to the spirit and intent of increasing diversity on campuses. Without widespread institutional change, American Indians will continue to be underrepresented in higher education in SEM fields.

I wish to thank Shirley Powell, Ph.D. for reviewing this paper.

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*\*The phrase stepping out reflects the mode of college attendance among participants in this study characterized by leaving the arena of higher education for various reasons and lengths of times before returning to complete a degree. The term connotes individual choice, in contrast with individual failure brought to mind by other phrases such as dropping out, stopping out, and leaving. ([Back to top](#))*

## Footnotes

1. In this article American Indian also includes Alaskan Native.
2. This research was funded by a grant from the Alfred P. Sloan Foundation.



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**Science, Mathematics, Engineering and Technology Retention Database**

*By Theresa Y. Smith, Director, Center for Institutional Data Exchange and Analysis, The University of Oklahoma*

Studies of college graduation rates have consistently shown that blacks, Hispanics and American Indians graduated at a lower rate than whites and Asian Americans (Astin, 1993; NCAA, 1997). A 1998-99 report of 269 colleges and universities in the Consortium for Student Retention Data Exchange (CSRDE) indicated that 54 percent of the 1990-92 entering freshmen graduated in six years. The comparable graduation rates for underrepresented minorities were 33 percent for American Indians, 38 percent for blacks and 41 percent for Hispanics. These rates were substantially lower than the graduation rates for white and Asian students. Consequently, the disparities in the representation of blacks, Hispanics and American Indians widened as students progressed from college entry to graduation. Underrepresented minorities constituted 13.4 percent of the 1990-92 entering student population, yet they accounted for only 9.7 percent of those who graduated within six years.

Specific retention studies for science, engineering, mathematics and technology (SMET) majors are generally limited in scope. The only national database available was a 1995 study of 33 institutions in the NSF Research Career for Minority Scholarship and Alliances for Minority Participation programs. The study reported similar racial disparities in the graduation rates of SMET majors. Their six-year institution-wide graduation rates were 41 percent for blacks, 45 percent for Hispanics and 25 percent for American Indians, compared with 60 percent for whites and Asians. The SMET-specific graduation rates were lower than the institution-wide rate; they varied from 29 percent for blacks, to 24 percent for Hispanics, 10 percent for American Indians and 37 percent for whites and Asians. Again, substantial differences existed between the underrepresented minorities and whites. This large

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difference in baccalaureate attainment is a major cause for the underrepresentation of degreed minority professionals in the SMET fields.

To overcome the lack of minority graduates and their subsequent participation in the SMET professions, the NSF has established as one of its goals "to increase the number of minority and other students who successfully complete baccalaureates in SMET." Several areas of racial disparities need to be addressed in order to achieve this goal. At the postsecondary level, it is important to bridge the differences in the following areas: precollege academic preparedness, college enrollment rates and college graduation rates. The strategies for intervention, therefore, should include remediation, recruitment and retention respectively. While all areas of intervention are important and interrelated, the shortage of data for monitoring the effect of retention programs is particularly prevalent. Existing statistics suggest that by closing the racial gap in graduation rates, we can achieve an increase of 40 to 50 percent in underrepresented minority degree recipients each year. Therefore, when working toward the goal of equitable participation of underrepresented minorities in the science, mathematics, engineering and technology (SMET) fields, one cannot overstate the importance of implementing retention programs for improving the graduation rate of underrepresented minority SMET majors. Equally important is a database for evaluating the effect of retention programs over time and across geographical regions and institutional classifications. This database does not exist today.

In August 1999, the Center for Institutional Data Exchange and Analysis (C-IDEA) received a three-year research grant from the Research on Educational Policies and Practices program at the NSF. The goal of this research is to meet the need of a national SMET retention database. Since 1994, C-IDEA has successfully organized the data exchange activities in the CSRDE. The consortium now has a membership of more than 350 colleges and universities in the current year. The CSRDE is now being used as a core group for soliciting survey participation, and its collaborative approach, as a model for information sharing. Each of the consortium members will be asked to participate in the annual survey. In return, each member will be entitled to the reports and analyses produced. In addition to data sharing, the project will offer a forum for on-going discussions about effective programs for improving the retention of underrepresented and female SMET majors. A list server and a quarterly newsletter will be developed to facilitate frequent discussions and information exchanges among the members.

The project has been in progress since September, 1999. In addition to the Principal Investigator, Theresa Y. Smith, and the C-IDEA staff members, the project personnel includes a group of six advisors: Philip Garcia, University of

Notre Dame; Myrtes Dunn Green, Stillman College; Gerald W. McLaughlin, DePaul University; Marsha K. Moss, University of Texas; Masha Hirano-Nakanishi, California State University System; and Jeffrey A. Seybert, Johnson County Community College. They are among today's leading institutional research professionals for having made substantial contributions to the studies of student outcomes assessment, longitudinal studies and/or minority participation in higher education. The group held the first advisory meeting in October to finalize the survey instruments and its process. The survey instruments are now being posted on the CSRDE web site, <http://www.occe.ou.edu/csrde>.

In the first year, about 350 colleges and universities in the CSRDE are invited to participate in the SMET retention survey. Also included are 75 four-year degree institutions in the two programs sponsored by the NSF: the Louis Stokes Alliance for Minority Participation Program and the Historically Black Colleges and Universities-Undergraduate Program. To date, nearly 140 colleges and universities have signed up for the survey ([See list](#)).

The survey is designed to measure, by race and by gender, the year-to-year retention rates of SMET majors for a period of six years beginning with the semester they entered college. The surveys were distributed to colleges and universities in February and the due date for completing the survey is May 31. The project plan is to publish the first annual SMET retention report by July 31. The 1999-2000 SMET retention database along with a query system will be posted on the CSRDE web site for data analysis by all the survey-participating institutions by the end of September.

The second survey cycle will begin with October 1. In the second year, the survey instrument will include additional cohort groups of sophomore and junior SMET transfers. Special emphasis will be placed on publishing reports and research papers and in encouraging the usage of these publications. Included in the process, will be opportunities for dialogues among the participating institutions on issues relating to retention data, policy and practices.

As the project progresses, special efforts will be made in expanding the scope of survey coverage and in increasing the number of participating institutions. When the project ends in September 2002, the plan is for it to become self-supporting. A membership fee will be required for all participating institutions. It is the PI's belief that by providing useful and quality information, the data collection process will be able to sustain itself through membership support after the initial three-year funding period.

Collectively, the work of the survey-participating institutions will culminate into a longitudinal database including gender- and race-specific retention and graduation statistics for the general student population and for the SMET majors. This database will be used to produce analyses and reports on a regular basis. Over time, the regularly compiled data will offer an important historical context for observing changes and trends. The primary data application is to provide timely observations of the effect of policies and practices on degree attainment of underrepresented SMET majors.

Examples of specific questions that may be addressed using this data base include:

At what rates do SMET majors progress in college from year to year over a period of six years? When are the SMET majors most likely to drop out from college? How do retention and graduation rates of SMET majors differ by race and gender? How effective is a given intervention program for improving retention and graduation rates of underrepresented SMET majors? To what extent, are the SMET student retention and graduation rates affected by institutional and student characteristics? Are there differences in the retention and graduation rates between transfers and "native" students? Which institutions have the highest graduation rates of underrepresented minority SMET majors? What are the characteristics of these institutions and their students?

As stated earlier, data on undergraduate SMET student retention and progression is lacking and regularly published national longitudinal studies about SMET majors do not exist. This project will bring about the first and a regularly published report to provide the retention and graduation rates of SMET majors with an emphasis on those for the underrepresented minorities. One of the most important mechanisms for sustaining an educational reform is a well-designed and regularly updated database that permits routine reviews of policies and practices. Colleges and universities will be able to use this database as a mechanism to measure the effectiveness of programs designed to improve minority participation in SMET disciplines on their respective campuses. The project is designed to reach individual colleges and universities. The grass-root interest and experience that will be cultivated in the process can work as a driving force for improving the retention of underrepresented SMET majors.

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## **A Profile of an AGEP Institution: University of Florida**

### **Introduction**

The University of Florida is the oldest university in the Florida State University System and ranks among the top ten state universities in terms of the number of National Merit and Merit Achievement Scholars in attendance. In 1996, the University was ranked 14th in terms of the total number of doctorates awarded. Along with Ohio State University and the University of Minnesota, UF offers more academic programs on a single campus than any of the nation's other universities, so the opportunities for work at the doctoral level in science and engineering are many. The University offers science, mathematics and engineering doctoral students the opportunity to work in major interdisciplinary research facilities, including the National High Magnetic Field Laboratory, the Brain Institute, the Engineering Research Center for Particle Science and Technology (ERC), and the Biotechnology Program.

The University of Florida has recently committed to an ambitious plan to increase the participation of students in graduate level education at UF. The goal is to increase the percentage of graduate students to correspond to the high quality of UF faculty research programs and the substantial and growing level of externally funded research. UF recognizes it must ensure that these educational opportunities are available to a diversity of students and the NSF Alliance for Graduate Education and the Professoriate is an important component of this overall plan.

The University of Florida has made a long-term commitment to diversity. Over the last 5 years, the percentage of African American and Hispanic students awarded PhD degrees at UF has generally exceeded national averages. The University of Florida was recently recognized by the Quality Education for Minorities Network as a leading producer of minority Ph.D.'s in mathematics, computer science, physical science, and engineering.

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*Florida A&M alumnus Johnny Davis, is one of the first UF Alliance for Graduate Education and the Professoriate Scholars. He has begun his PhD program in the Microbiology and Cell Science Department.*

Florida A & M University (FAMU) is a historically Black 1890 Land Grant institution located in Tallahassee. A major FAMU focus is the recruitment of talented students for careers in engineering, mathematics, and the sciences to address critical manpower needs in the twenty-first century. Some 30% of the students at the University are enrolled in programs in the physical, biological, and health sciences; mathematics; computer sciences; agriculture; and engineering. As a result of aggressive recruitment activities, the size of the freshman class has increased from 704 students in 1985 to more than 2,000 in 1997.

The NSF Alliance for Graduate Education and the Professoriate program couples the major graduate research university in Florida with the undergraduate institution that produces the highest number of minority undergraduate science and engineering baccalaureate degrees in the state. These two institutions have a proven track record of successful collaborations. A valuable expansion to the program underway is the engagement of all of the schools participating in the Louis Stokes Florida-Georgia Alliance for Minority Participation (FGLSAMP) in the program. The FGLSAMP project represents 13 institutions across Florida and Georgia and is currently preparing a large number of science, engineering and mathematics (SEM) undergraduate students. This expansion will allow the program to have an even broader impact.

**The Alliance for Graduate Education and the Professoriate Program**

The NSF program established by UF and FAMU builds on the strengths of past programs and extends these efforts through the development of a long-term, professional development program with the ultimate goal of increasing the number of minority faculty in science and engineering. This plan is complementary to many other efforts underway but is the first to combine all stages by making connections with students early in their undergraduate careers, recruiting, providing transition assistance, offering retention support, and providing critical professional

development skills all in one comprehensive program.

This program identifies program participants in the Spring semester of the sophomore year. Students who are chosen to participate in the program attend a workshop on the University of Florida campus. During the workshop they participate in laboratory tours, seminars on practical issues involved in preparing for graduate school, and meetings with department representatives and graduate students to discuss other areas of interest.

The purposes of this initial visit are many. Relationships between minority students and faculty are related to retention. Initiating these connections early in the student's academic career will facilitate these personal contacts. Additionally, students need practical information on admissions requirements, as lack of adequate preparation is an obstacle to graduate school. Guidance at this stage addresses this potential obstacle. By meeting with departmental representatives before the junior year, students become aware of what prerequisites are required by the department of their choice to ensure that they take courses required to meet their career goals. Also, contact with minority graduate students enrolled in Ph.D. programs at UF provide role models for these students.

Students participate in research experiences at FAMU to provide them with accomplishments to instill self-efficacy in the area of science and/or engineering research, so important to career choice. In the summer between the Junior and Senior years, students participate in a 10-week research experience on the UF campus. During this program, students participate in a seminar series, industry tours, and communication workshops. Seminars include student panels discussing topics including what to expect from graduate school, how to choose a graduate program, and how to apply. At the conclusion of the program, students turn in a research paper and make an oral presentation to help them improve their oral and written communications skills.

Students are assisted with the UF admissions process and admitted students are supported on a fellowship the first year to allow them to concentrate solely on their academic program. The first AGEP class of 6 students began programs in Materials Science and Engineering, Civil Engineering, and Microbiology and Cell Science. To facilitate the transition to graduate school, during the summer following acceptance into the Graduate School at UF, students participate in a 6-week orientation semester, modeled after the Board of Regents Summer Program which has been offered to new African American graduate students at UF. During this semester, students participate in research work with their faculty advisor, attend practical seminars designed to facilitate the transition to the UF campus, and enroll in one academic course in their department. Students are encouraged to form study groups and supportive relationships with the other members of their cohort. Beginning in this semester, and continuing throughout the entire stay at UF, participants attend regularly scheduled meetings with program managers in order to monitor student progress and foster a community feeling among group members.

Some of the non-research responsibilities of a faculty position include teaching graduate, undergraduate, and professional courses; getting financial support for research and graduate students; publishing research articles and textbooks; directing graduate research; mentoring and advising both undergraduate and graduate

students; and participating in academic, administrative, and service responsibilities. To provide these students with the skills they will need as faculty members, the students will participate as TA's during their second year. They will be assigned to mentor the new class of AGEPE Scholars. A student's shift from mentee to mentor is part of the progression from graduate student to professor. The relationship not only serves to minimize isolation, but it becomes an important part of the professional development of the students as they prepare to enter the professoriate where mentoring skills will be extremely important.

During subsequent years, these students will receive Research Assistantships in their department.

Another program element that is included in this program is funding to ensure that each student attends at least two national professional meetings, one to a minority science and/or engineering conference and one to the broader professional society that represents their field. The former is included to allow students to begin networking with other graduate students and to be exposed to role models in their field. UF AGEPE Scholars have attended the Compact for Faculty Diversity 1999 Institute on Teaching and Mentoring, the Quality Education for Minorities Network Conference, and the National Society of Black Engineers Conference. In their third year, students will be expected to participate through either a presentation or poster session at a national meeting, which will continue their professional development and preparedness to enter academia.

This program is a comprehensive, stepwise process that encourages and prepares exceptional minority students for an academic career by guiding them from the undergraduate through a Ph.D. education. Fellowships, tuition waivers, mentoring, academic support programs, teaching experience, and travel to professional meetings will result in 10 additional minority Ph.D.'s each year, as well as systemic change that will result in the continuation of the program beyond the fifth year.

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