
FIRST: A MODEL FOR INCREASING QUALITY MINORITY PARTICIPATION IN THE SCIENCES FROM THE UNDERGRADUATE TO THE PROFESSORIAL LEVEL^{1*}

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Programs that have increased the number of minorities and women in science at the K-12 and undergraduate level have not resulted in a corresponding increase in these groups in postdoctoral and faculty positions. Fellowships in Research and Science Teaching (FIRST) address this glaring weakness in segments of the science "pipeline." FIRST is a 3-year postdoctoral fellowship integrating a traditional research experience at a research institution with a mentored teaching experience at a minority-serving institution. Data presented demonstrate that FIRST has many of the characteristics for creating the supportive environment necessary for such programs to succeed. FIRST fellows develop an effective community and have a quality research experience (as measured by publication quantity and quality) and teaching experience (as measured in fellow, student, and mentor surveys), which translate into their receiving faculty positions. Participating research and minority institutions also receive benefits, including increased research and teaching collaboration, expanded curricula, and greater participation of minorities and women at many levels.

INTRODUCTION

A wide array of programs have been developed to recruit, retain, and promote women and under-represented minorities (URM) in science and engineering. At first glance, these programs have been a success. In a recent National Science Foundation (NSF) survey, women and URM, specifically those of Black or Hispanic origins, represented about a quarter of those involved in science and engineering careers (NSF, 2004), and the number of women and URM receiving undergraduate and graduate degrees in science and engineering has gradually increased since 1966 (NSF, 2004). These programs tend to impact only specific segments of the "pipeline." The pipeline can be defined as the process moving young scientists from their undergraduate bachelor's degree to Ph.D. programs to postdoctoral fellowships to faculty positions. A result from a break in the scientist pipeline is a lack of proportionate increases at the two highest levels of postdocs and faculty.

Women and URM represent only 11% of the total science and engineering faculty in colleges and universities. While 45% of Ph.D.'s awarded in biology in 2001 went to women, only 34% of those employed as faculty in the fields of biology and medicine were women (NSF, 2004; Sears, 2003; Etzkowitz, Kemelgor, & Uzzi, 2000). The proportion of women and URM is lower still in research institutions (NSF, 2004). In the case of the University of Michigan, for example, 35% of the social sciences and only 13% of natural sciences faculty in 2003 were women (Center for the Education of Women, 2003), and the trend is the same with URM. These data are especially troubling in light of the fact

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that most institutions, the University of Michigan included, have special programs and incentives in place specifically to make target hires of women and minorities.

One key part of the pipeline that is contributing to these distressing numbers is the decline in Ph.D. scientists who move from that degree to a postdoctoral fellowship. Postdocs obtain training in basic science research as well as skills in grant writing, faculty interaction, and, less often, teaching. Time spent in at least one such fellowship is now expected of anyone who wants to become an assistant professor at a research university, and it is unusual now that even good teaching colleges will hire Ph.D.'s who have not had at least one postdoctoral experience. Statistics from the NSF (2004) show a significant drop in the number of women and URM moving from Ph.D. programs into postdoctoral training programs in the sciences or engineering. Reasons abound to explain why there is a shortage of URM professors. Discrimination, tenure decisions, bias, and a myriad of other reasons have been proposed by leading scholars, administrators, and social commentators (Anderson, Astin, Bell, Jr., Cole, Etzioni, Gelhonr, Giffiths, Hacker, Hesburgh, Massey, & Wilson, 1993). The result of this drop-off is the loss of potential science faculty, mentors, and teachers to careers outside of academia, and sometimes, outside of science altogether.

Reinforcing the Pipeline

The report, "Environments of Support," published over a decade ago by the Office of Minorities in the American Council of Education, outlines general strategies for improving the situation of minorities in doctoral programs (Wagner, 1992). These strategies continue to be relevant to all segments of the pipeline. Segments include aggressive and targeted recruitment, multiyear fellowships, a locus of academic and social support, an atmosphere of high expectations for success, departmental cultures that support faculty mentoring, student support groups, and a "critical mass" of minority students and faculty. The importance of critical mass is discussed in a number of more recent studies over the past decade (Etzkowitz et al., 2000; Sonnert & Holton, 1996; Valian, 1999; Stewart, LaVaque-Many, & Malley, 2004).

To address these pipeline problems, in 1998 the Minority Opportunities in Research Division (of the National Institute of General Medical Sciences, one of the National Institutes of Health) developed the Institutional Research and Academic Career Development Award (IRACDA) Initiative. Grants awarded from IRACDA require a partnership between a research university and one or more minority-serving institutions (MSI). Programs are to provide a traditional mentored postdoctoral research experience complemented by a mentored teaching experience at an MSI.

The FIRST Program

Fellowships in Research and Science Teaching (FIRST) is currently in its 5th year of IRACDA funding and has recently been refunded for another 5 years. Programmatic details of FIRST are described in detail elsewhere (Holtzclaw, Penumetcha, Whitney, Eisen, Hoey, & Kimbro,, 2005), so we provide only a brief outline of the program here. FIRST is a consortium of five Atlanta institutions: Emory, a research institution, and the four Atlanta University Center (AUC) MSIs (Clark Atlanta University, Spelman College,

Morehouse College, and Morehouse School of Medicine). FIRST postdoctoral fellows are accepted into the program for 3 years. While performing research in a laboratory, the fellows participate in a tripartite teaching development program as follows: (a) a one-semester course in the 1st year on the philosophy and practice of teaching combined with an actual course-within-the course that the fellows teach themselves, (b) identification of a teaching mentor at one of the AUC schools with whom they prepare over the 2nd year to take a leading role in a course, and (c) opportunity to teach the new or modified course in the 3rd year.

The broad conceptual goal of FIRST is to directly implement the strategies discussed above from the "Environments of Support" report (Wagner, 1992). The more concrete objectives are: (a) to increase the number of well-qualified under-represented minorities entering competitive careers in biomedical research by strengthening the pipeline at the undergraduate, postdoctoral, and faculty levels; (b) to enhance research backgrounds of developing scientists to conduct high quality research in an academic environment; (c) to further promote interaction between Emory University, the AUC schools, and Morehouse Medical School that will lead to further collaboration in research and teaching; and (d) to enhance research-oriented teaching at the AUC schools.

We present and analyze data examining the effectiveness of FIRST as a model program for strengthening the science pipeline and discuss its implications.

METHODS

Professional outside evaluators (Joseph Hoey, Georgia Institute of Technology, and Bethany Bodo, Radford University) used a mixed-methods approach to evaluate FIRST. Evaluation design was developed to be both formative and summative. Collection of data placed special emphasis on the development and success of the postdoctoral fellows. A notable feature of the design was the inclusion of comparison group tracking, reporting, and analysis to determine the relative success of the FIRST fellows in comparison to postdoctoral fellows in other NIH training programs.

The surveys, interviews, tracking methods, and artifact assessments used to evaluate the following program areas included: (a) interinstitutional cooperation (surveys of participating parties and tracking of outcomes); (b) interactions of all participating individuals (surveys and interviews with fellows, teaching and research mentor surveys and focus groups, undergraduate students of teaching fellows); (c) the fellows' experiences in the program (interviews, surveys, objective measures of outcomes, personal success, and satisfaction); (d) comparison of fellows in the FIRST program with other graduate students at Emory University (nonequivalent group design, demographic analysis, productivity measures, survey measure comparison); (e) recruitment efforts, research endeavors (laboratory work conducted by the fellows, time spent in research, presentations, and papers); (f) teaching endeavors (web course instruction, course teaching, assessment of teaching modules during the 1st year, course development, course portability once developed); and (g) participant experiences in the program.

RESULTS

Application and Acceptance Pool

The program is open to any federally qualified applicant who has obtained a Ph.D. in science and is funded for 10 fellows per year, each for 3 years. Table 1 shows that FIRST is able to attract a diverse pool of applicants from which less than 50% are accepted. Half of the matriculating FIRST fellows are URM and over 70% are women. These percentages are 2 to 3 times greater than the comparison group of all Emory postdoctoral fellows.

Table 1. Who's in FIRST?

	Program Year				Total	% of Applicants
	'00/'01	'01/'02	'02/'03	'03/'04		
Eligible applicants (U.S. citizens or permanent residents)	31	20	18	28	97	100%
Eligible minority applicants	14	8	8	13	43	44%
Eligible female applicants	12	14	16	22	64	66%
Withdrawn applications	2	2	1	1	6	6%
Applicants interviewed	14	14	13	22	63	65%
Offers extended	14	14	10	21	59	61%
Accepted applicants declining fellowship	6	0	3	3	12	12%
Matriculates	8	14	7	18	47	48%
						% of Matriculates
Minority matriculates	4	8	3	8	23	49%
Female matriculates	7	8	4	16	35	74%

Assessment of FIRST Fellows Research Quality and Publications

During the first 4 years of FIRST, fellows had 105 publications in peer-reviewed journals; 61 of the publications had a FIRST fellow as the initial author. A more conservative statistic is the number of publications that occurred while the fellows were in training in the FIRST program; this ignores work that was completed during training but was not published until after the fellow had left the program. Table 2 summarizes these results.

During the report period there were 47 FIRST postdoctoral fellows, 24 of which were under-represented minorities. 32 postdoctoral fellows (competitive NIH fellowships) at Emory were used as a comparison group for these data. For comparison purposes, it is important to consider the total training time because FIRST fellows train for a maximum

of 3 years. All fellows, whether in the FIRST program or not, publish at approximately the same rate (Table 2). Minority fellows, whether in the FIRST Program or not, have the same publication rate as T32 fellows; the publication rate of minority fellows in the FIRST program is slightly less than the publication rate for FIRST fellows overall, but the same as T32 fellows overall.

The impact factor is an index representing the importance of a journal based on how often it is cited and read. As evidenced in Table 2, the impact factor of journals in which T32 fellows and FIRST fellows publish is comparable. Journals in which FIRST minority fellows publish is significantly higher than that of other Emory minority postdoctoral fellows.

Table 2. Publication Record for FIRST Fellows and Other Postdoctoral Fellows at Emory University School of Medicine

	Total Number Fellows	First Author Publications	Median Impact Factor	Total Publications During Training Period	Total Training Years	Publications/ Years of Training
All FIRST fellows	47	45	3.88	77	77.2	0.997 ± 0.023
All T32 fellows	58	47	3.87	99	127.8	0.775 ± 0.035
FIRST under-represented minorities	24	14	4.18	29	36.9	0.786 ± 0.040
All other under- represented minority post- doctoral fellows at EUSOM	31	36	3.60	69	86.3	0.799 ± 0.027

Note: EUSOM = Emory University School of Medicine

Teaching Quality and Experience

We evaluate the effectiveness of the FIRST teaching experience using focus groups and surveys of the undergraduates taught by the fellows at the MSI, the fellows, and their teaching mentors. In a representative sample of courses taught by FIRST fellows, undergraduate student survey respondents self-report as being engaged at high cognitive levels on Bloom's Taxonomy of mental activities. In fact, in the highest level of "applying theories or concepts to the solution of practical problems," ratings average over a 3.75 (5 = *very much* to 1 = *very little*).

When undergraduate students are asked to rate the FIRST fellows on the extent to which their instructional style matches the *Principles for Good Practice in Undergraduate Education*, (Chickering & Gamson, 1987), the student ratings averaged over 4.5 (5 = *excellent* to 1 = *poor*) for the FIRST fellows in four notable areas: (a) encouraging active learning, (b) showing concern for student learning, (c) incorporating teamwork as part of learning, and (d) designing course websites and on-line materials.

In general, undergraduate students were very positive about their experiences with the FIRST fellows. The students rated fellows over 4.5 (5 = *very satisfied* to 1 = *very dissatisfied*) in syllabus-to-course match, timeliness in instructor feedback, and overall effectiveness. In all areas, the undergraduate students indicated that their knowledge and skills increased by the end of the course.

Overall, undergraduate students indicated they derived substantial knowledge gains from the courses taught by FIRST fellows and enjoyed having the FIRST fellows teach their courses. These comments were typical of those on the open-ended part of

the evaluations. "It was extremely effective in helping me to learn the material. The details provided and knowledge of the subject was great and contributed to the overall learning process." "[The] professor did an excellent job of communicating the lessons in order to assure the student has a thorough command of the labs."

In the area of course value to their career goals, mean ratings of 3.87 were given (1 = *not valuable* to 5 = *very valuable*), and in terms of value to their educational goals, undergraduate students gave the courses a mean rating of 4.19.

As suggested in student evaluations and noted in mentor surveys, because of their relative youth and enthusiasm for their work, FIRST fellows have served as powerful role models for students, inspiring them to pursue careers in research, particularly in academia. Undergraduates have found the FIRST fellows easy to approach and have sought their advice not only on career decisions but personal ones as well.

MSI Institutional and Mentor Feedback

How do MSI faculty and the MSIs themselves—components vital to a successful and strong science pipeline for minorities—benefit from FIRST?

The dean of science and mathematics at Morehouse College states that perhaps the most important benefit of FIRST fellows to the MSI is that they bring to these colleges knowledge of contemporary topics in research and research methods. Because of heavy teaching demands, it is a challenge for faculty members at AUC institutions to do competitive research. Both lecture and laboratory experiences can become somewhat dated, and as a result, students are not as well prepared for graduate or professional school as they might be. At Morehouse College, faculty sought to take advantage of the capabilities of FIRST fellows in this area, in part, by having them provide instruction in a two-semester biology research course (Bio381-382). Before the involvement of FIRST fellows, the entire course experience took place in the laboratories of various faculty members. FIRST fellows, in conjunction with their teaching mentors, thought that students would be better served if they were provided with various intellectual underpinnings of research through lectures. While laboratory research remains the major component of the course, FIRST fellows developed and continue to teach (passed on from one to another) a lecture component of the course.

As a consequence of the "How to Teach" course in which they participate in the 1st year of the program, FIRST fellows also bring to the AUC colleges knowledge of the latest thinking on how students learn and the most effective instructional techniques such as active and collaborative learning. By sharing this information and demonstrating the effectiveness of new strategies, FIRST fellows help to catalyze reform in the educational program within the departments in which they work.

FIRST fellows help to meet staffing needs at MSIs. Often, not enough full-time faculty members are available to teach all of the course sections that they wish to offer, particularly laboratory sections. Thus, the schools must make use of part-time instructors, the training of which is typically less than that of full-time instructors. Because of their state-of-the-art knowledge in particular areas of research, FIRST fellows have also allowed the MSIs to offer new courses, which the FIRST fellows develop and teach.

As a result of becoming familiar with FIRST fellows during their apprenticeship

teaching in AUC institutions, AUC faculty members are able to directly assess the suitability of the FIRST fellows as prospective faculty members, and the fellows obtain an overall view of the institution. This leads to far more informed decision-making on new faculty hires. The teaching mentor may become a champion for the new faculty hire and provide valuable mentoring for career development. In fact, the AUC has hired five FIRST fellows as faculty.

Finally, FIRST makes links between faculty and students at minority-serving institutions and faculty and students at research-intensive institutions. Interactions between Emory University faculty and AUC faculty have led to collaborative research efforts and the use of Emory faculty when they are needed to teach courses in the AUC. We expect that, as faculty interactions continue to increase, mutually beneficial relationships will also increase in the future.

Fellow Feedback

Fellows perceive the FIRST program as having a positive effect on their field of work and on their personal and career aspirations. Fellows make a number of comments on the networking aspects of the program that have had a positive effect on their success. Fellows express the perception that certain areas of the program itself have helped them in their development. Generally, the areas cited repeatedly by fellows as having the most impact were the teaching experiences and training as well as the support and networking they have received from the program.

When fellows were asked about the program's effect on their teaching skills, all respondents indicated that their teaching skills were either greatly increased or slightly increased. When asked for a summative evaluation, all fellows in Emory University's FIRST program expressed overall satisfaction with the program.

One of our 1st FIRST graduates, Andrea Morris, an assistant professor of biology at Haverford College, was recently quoted by Dr. Jeremy Berg, director of the National Institutes of General Medical Sciences, in a talk to the Association of American Medical Colleges.

I believe that the greatest benefit to completing the IRACDA postdoc is **preparation**. As a new faculty member, I felt **well-prepared** to develop my **independent research ideas** and build a productive new laboratory; prepared to **bring effective teaching methods and experience to undergraduate science classrooms** and prepared to face the challenges of academia (especially as a woman of color) because of having **an extremely extensive and supportive professional network already in place**. [Emphases added by Dr. Berg]

The Benefits of "Critical Mass"

Being a postdoctoral fellow in the natural sciences has been, in general, a relatively socially and academically solitary part of the science pipeline. While graduate and undergraduate students have their classmates and principal investigators have faculty colleagues, postdocs are isolated in their own laboratories. Only recently have we developed Offices of Postdoctoral Education and similar institutional organizations.

This inherently asocial nature of postdoctoral fellowships may make this segment of the pipeline particularly vulnerable for all, but especially for minorities and women. Data from "Environments of Support" and numerous other sources support the idea that scientific and social community, especially composed of individuals with similar aspirations, will more likely result in individual success (Etzkowitz et al., 2000; Sonnert & Holton, 1996,; Valian, 1999; Stewart et al., 2004; Wagner, 1992).

Perhaps the most valuable aspect of FIRST, then, is the annual establishment of a community of 10 fellows with similar aspirations, many of whom are women and minorities. The postdocs in each cohort take classes and workshops together, share an intensive teaching experience together, and, as a result, form a network of scholars that is strengthened throughout their careers. As noted, fellows frequently state in their evaluations the importance of the networking and community that FIRST has allowed them as a leading source of their confidence and success.

FIRST not only has developed a community of minority and women postdocs, but the program has significantly impacted the number of minority postdocs at Emory overall. Table 3 shows that, during the last 3 years of the FIRST Program, the FIRST fellows represented (on average) approximately 30% of all the under-represented minority postdoctoral fellows at Emory. The successful interaction and networking of FIRST fellows was an important reason for the establishment of the Emory Office of Postdoctoral Education for all Emory School of Medicine postdoctoral fellows.

Table 3. Postdoctoral Trainees at Emory University School of Medicine

	1999	2000	2001	2002	2003	2004*
	Non-FIRST Trainees					
Total (US/PR)	170	179	191	218	243	260
Total minority	24	30	35	48	54	46
% minority	14	17	18	22	22	18
	FIRST Trainees					
Total (US/PR)	0	5	19	28	32	32
Total minority	0	3	8	14	15	14
% minority	0	60	42	50	47	44

Note: PR = permanent resident

*Jan.-Sept.

Fellows Spontaneously Develop Academic and Social Activities

FIRST fellows, especially within a given cohort, form their own communities. They get together for lunches and social functions, establishing the kinds of activities that faculty and students do.

FIRST now has a monthly seminar series in which fellows present their diverse research to each other. This seminar has become a valuable venue for fellows testing their job talks with a friendly audience and gaining constructive criticism. Often postdocs who must present research talks and simulated teaching sessions at their job interviews

have no audience to practice on. Having the FIRST community as a test audience has made a big difference in the fellows' preparations.

FIRST has an active intranet site to discuss teaching issues the fellows face, to keep the community up to date, and to report on teaching workshops attended. The 1st-year FIRST classes, sample teaching portfolios and job applications, and other relevant materials are also on this site.

Having a critical mass of minority and women fellows with common interests also allows the postdocs to develop teaching scholarship, almost unheard of in traditional science postdoctoral fellowships. FIRST fellows collaborate to publish papers, to perform and present teaching research at conferences, and to develop public workshops such as "Race, Gender, and Teaching Science." FIRST fellows actively engage in faculty teaching development workshops on the Emory and AUC campuses and provide strong teaching resources for local institutions and science outreach and education programs. These experiences improve the education community as a whole in addition to providing fellows with rich career development opportunities.

Fellows Gain Faculty Positions in Academia

If FIRST is effectively strengthening the pipeline at the postdoctoral level, fellows should be obtaining good positions upon completion of their fellowships. Because FIRST is only in its 5th year of existence and fellowships are 3 years long, data are limited, but initial returns are extremely encouraging. Table 4 summarizes the status of FIRST graduates to this point. Of 9 minority graduates, 7 are in academic positions; of the 8 women graduates who did not go on to do another postdoc (many scholars participate in two postdocs prior to applying to more permanent positions), 6 are in faculty positions and one in industry.

Perhaps the strongest sign of the success of FIRST is that a quarter of program graduates (all minority and four women) are now faculty at the AUC itself. This strengthening of the pipeline at such a local level creates considerable advantages. Soon these faculty will become FIRST teaching and/or research mentors themselves, and they often engage in FIRST supporting activities such as the annual teaching mentor and FIRST fellow workshop developed to build a contact between AUC mentors and the teaching fellows who are initiating work with them.

Table 4. Placement of FIRST Graduates

Class	Graduates	Under-Represented Minorities	Women	Academic Positions	Industrial Positions	Additional -Postdoctoral	Other ^a
2000	5	3	5	4	0	0	1
2001	10	5	5	5	1	5	1
2002	4	1	3	2	0	1	0
2003	1	0	1	1	0	0	0
Totals	20	9	14	12	1	6	2

^aOther includes one unknown and one position in secondary science education.

DISCUSSION

A troubling disconnect exists between the increasing numbers of minorities and women entering the science pipeline early on and the disproportionately few who become postdoctoral fellows and faculty. The FIRST program is designed to provide a supportive environment for minority, women, and other fellows to have an integrated and mentored research and teaching experience meant to mirror their future faculty experiences. FIRST establishes an important critical mass of minorities and women who form an effective and engaged community. We have presented data to support the success of this FIRST community.

A recent report from the NSF shows that faculty members at all institutional levels, including primarily teaching institutions, are often required to conduct research and publish their findings. FIRST fellow publication rates and the impact factor of those publications are as high as or higher than their companion postdocs in a competitive NIH training program. FIRST fellows have been provided with expert mentoring in biomedical research. This is a critical criterion for hiring and retention of faculty members, especially at a research institution.

In addition, as elaborated in focus groups and surveys with AUC students taught by FIRST fellows, teaching mentors, and fellows themselves, the FIRST teaching experience is rigorous and positive, providing fellows with a leg-up in pursuing faculty positions. Anecdotally, former fellows report that their significant teaching portfolios made their applications stand out at the institutions in which they were hired.

It is no surprise, then, that FIRST fellows have done extremely well in job placement. Nearly all graduates (those who did not go on to do another postdoctoral fellowship), including a large percentage of women and minorities, have obtained faculty positions of their choosing. Most notably, five former FIRST fellows are now faculty at the AUC itself. Soon, these FIRST graduates will be serving as FIRST teaching and research mentors themselves, and they are already encouraging more young people to enter the pipeline from which they have emerged.

The institutions involved in FIRST also benefit from the program. FIRST accounts for approximately 30% of all minority postdocs at Emory. In addition, the positive impact of an established social and academic critical mass of postdoctoral fellows with common interests working together has raised Emory's profile in a number of areas. The institution is now represented at many minority science meetings for undergraduate and graduate students at which FIRST fellows present the program and recruit for it; the Emory Office of Postdoctoral Education was developed partly due to FIRST fellows effective actions; and new presentations and publications in both research and teaching have emerged from the program, including new collaborations with the AUC institutions. Preliminary evidence also suggests an increase in the number of AUC applications to Emory biomedical Ph.D. programs. Finally, in a time when many researchers in the biomedical sciences are struggling to find quality candidates for postdoctoral training, FIRST, and therefore Emory, has a large pool from which to choose. FIRST has managed to recruit and retain the very demographic that is sought after by faculty hiring committees and has not seen a drop in the quantity or quality of its applicants.

Although we have as yet no data to support it, the argument could be made that some minority and women Ph.D.'s may never try to enter the science pipeline at the

postdoctoral level without programs like FIRST. Certainly, FIRST has served to attract minorities to Atlanta and the AUC; minorities who otherwise would have gone elsewhere. This includes fellows who went to AUC institutions for their undergraduate degrees only to return to Atlanta and train with FIRST. One fellow received his bachelor's degree from Morehouse and his Ph.D. in Texas. He subsequently returned to Atlanta specifically to participate in FIRST and is now a faculty member at Morehouse, conducting cutting-edge research with undergraduates. This FIRST alumnus stated that the training from FIRST not only assisted him in getting a faculty position with Morehouse College but also allowed him to progress with his teaching and research at a much faster pace than would normally be anticipated for a junior faculty member—a good example of a strengthened pipeline.

In addition to providing the AUC institutions with future faculty, FIRST benefits them in numerous other ways. FIRST fellows aid in expanding and adapting their science curricula, developing and teaching new courses and laboratories (as an example, Holtzclaw et al., 2005), introducing new equipment and technical and pedagogical techniques, increasing exposure to research opportunities, and providing able and innovate manpower. The AUC undergraduates respond very positively to FIRST fellows and courses and see the fellows as positive role models.

To date, all indications are that FIRST is an effective model for increasing the number and quality of women and minority postdoctoral fellows and faculty in the sciences.

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