

Prairie View A&M University: Assessing the Impact of the STEM-Enrichment Program on Women of Color

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Abstract-Over the past two decades, Prairie View A & M University (PVAMU) has sponsored a number of Science, Technology, Engineering and Mathematics (STEM) enrichment programs to help improve the enrollment and retention of students in these career fields. Of these programs, the National Science Foundation (NSF) sponsored STEM-Enrichment Program (STEM-EP) is the most comprehensive program offered at the university. Initiated in 1999, STEM-EP is an innovative program designed to promote academic excellence of students who intend to pursue a degree in one of the STEM disciplines. The program is a multi-faceted initiative consisting of a nine-week summer residence program for recent high school graduates, coordinated scholarships and tutorials, peer and faculty mentoring, professional development training, and undergraduate research opportunities. Over 95% of the participants have been students of color (i.e., African-American, Hispanics, etc.), of which 35% have been women of color. The objective of this paper is to assess the data from six cohorts of STEM-EP participants (beginning with summer 2000) in order to examine the impact of the program on the retention and academic performance of the participants. The methodology used in the compilation of the data includes a review of the tracking data collected by the STEM-EP program managers for NSF reporting. An analysis of the data presented includes retention information for each cohort, grade point average (GPA), and a comparison of the retention and performance of participants disaggregated by gender.

Introduction and History

There has been a growing concern for the recruitment and retention of women and minorities in the fields of science, technology, engineering, and mathematics (STEM). This issue is particularly acute for engineering and technology disciplines. Historically speaking, women and minorities have made significant strides in increasing their representation in STEM fields. However, the overall percentages in certain disciplines are still quite low. A recent NSF Report indicates women earned more than half of all science and engineering bachelor degrees in 2002 (NSF, 2006). However, there were major variations across disciplines. Women earned 78% of the bachelor degrees awarded in Psychology and 59% in Biology, but only 21% in Engineering and 27% in Computer Science. Similar trends can be seen in engineering for other underrepresented groups. In 2003, the percentages of African Americans and Hispanics that earned bachelor degrees in engineering were 4.6% and 6.2%, respectively (Chubin, May, & Babco, 2005). Despite an overall increase in baccalaureate degree production, the proportion of women and minority freshmen in engineering has steadily declined since 1995 (Chubin, May, &

Babco, 2005). While the total numbers have been increasing for both groups, the numbers for men and non-minority freshmen have increased at a faster pace. Consequentially, the number of women and minorities entering the engineering and technology workforce is limited. These statistics indicate a very disturbing, but definite reality that is women of color are not adequately represented in the science and engineering profession. The implications of these statistics are monumental. In fact, according to Brainard and Carlin (1997), states that “without access to the decision-making positions in technology, women and other minorities will continue to be denied economic and social power”. This issue may have more acute consequences for women of color due to the dual disparities they experience from being both African American and female – disparities that are not typically addressed in most programs.

Moreover, the low percentages of women and minorities in engineering career fields has been partly attributed to inadequate preparation in mathematics and science as well as a lack of knowledge about overall STEM career opportunities. Summer enrichment programs established to increase diversity in higher education are an important element in stimulating underrepresented groups to pursue STEM related fields of study. In an effort to close the gap, Prairie View A & M University (PVAMU), a historically black university, has been successful in tapping a rich community of talented students of color and women by providing them with research and scholarly opportunities to pursue STEM fields of study. For more than three decades, PVAMU has sponsored a number of pre-college and bridge STEM-EPs. Some of these programs have included the Summer Transportation Institute (STI), Minority Introduction to Engineering and Science (MITES), Engineering and Science Concepts Institute (ESCI), and STEM-EP. The College of Engineering (COE) consistently ranks among the top 25 U.S. Universities producing African American engineering graduates. PVAMU is accredited by the Southern Association of College and Schools (SACS). It is also designated as a land grant institution with federal statute and a state-wide special purpose to provide key services to students of diverse ethnic and socioeconomic backgrounds. The university enrollment is 92 % African-American (PVAMU, 1999-2003). The COE at PVAMU has seven Accreditation Board for Engineering and Technology (ABET) accredited programs, namely, Computer Engineering Technology, Electrical Engineering Technology, Electrical Engineering, Mechanical Engineering, Chemical Engineering, Civil Engineering, and Computer Science. In 2004, the COE began a degree program in Computer Engineering which will undergo the accreditation process in 2008.

To date, the NSF sponsored STEM-EP is the most comprehensive academic enrichment program offered at PVAMU. Commenced in 1999, STEM-EP is an innovative initiative to promote academic excellence of students who intend to pursue a degree in one of the STEM disciplines. The objective of this paper is to assess the data from six cohorts of STEM-EP participants (beginning with summer 2000) in order to examine the impact of the program on retention and academic performance of the female participants. The methodology used in the compilation of the data includes a review of the tracking data collected by the STEM-EP program managers for NSF reporting. A statistical analysis of the data presented includes retention information for each cohort, grade point average (GPA), and a comparison of the retention and performance of participants disaggregated by gender.

Description of the Program

In 1999, NSF awarded PVAMU a five-year grant aimed at significantly increasing the number of students pursuing baccalaureate degrees in science, technology, engineering, and mathematics (NSF,1999). During its original inception, the program was opened to recent high school graduates who were entering college for the first time. Due to the success of the program, the program was refunded in 2004 and expanded to include additional enrichment activities (NSF, 2004). The program was developed to support three major components: (1) recruitment and retention, (2) student development and support, and (3) exodus to graduate schools and the STEM workforce. The original objectives of the program were to:

- Develop and maintain successful recruitment and retention programs for underrepresented groups within the STEM disciplines
- Increase partnerships with high schools, academic institutions, corporations and industrial/government laboratories
- Strengthen the current PVAMU STEM education and research infrastructure
- Ensure students are informed and prepared to transition from high school through the undergraduate curricula to graduate schools and industry
- Complement the HRD Comprehensive Partnership for Mathematics and Science Achievement (CPMSA) at the Beaumont Independent School District

The objectives were expanded to include:

- Increased undergraduate research experiences for STEM disciplines
- Establish university-wide STEM Scholars Program
- Establish a Transfer Student Initiative
- Develop a High School Mathematics Project

STEM-EP is a multi-faceted initiative consisting of a nine-week summer residence program for recent high school graduates; coordinated scholarships and tutorials; peer and faculty mentoring; professional development training; and undergraduate research opportunities. The nine-week summer residence program is a major component of the program and is the focus of this paper.

To be admitted to the program, participants must meet the following criteria:

- US citizen
- Minimum high school GPA of 3.0 on a 4.0 scale
- Scholastic Aptitude Test (SAT) scores of 900 or higher or American College Testing (ACT) scores of 19 or higher
- Interest and aptitude in one of the STEM disciplines
- Completion or exemption from the Texas Higher Education Assessment (THEA) Test

Data Collection and Analysis

The STEM-EP tracking system provides a mechanism for measuring retention rates, graduation rates, and academic performance of its participants. The STEM-EP participants were grouped into cohorts and tracked on a yearly basis through graduation. Table 1 provides information on each cohort. This information includes the number of graduates, participants that have left the program, and matriculation data disaggregated by gender. Cohort 1 began its first year in 2000 and has graduated or completed its sixth year; Cohort 2 began its first year in 2001; Cohort 3 began its first year in 2002; Cohort 4 began its first year in 2003; Cohort 5 began its first year in 2004; and Cohort 6 began its first year in 2005 and will be sophomores in the Fall of 2006.

Since 2000, the first year retention rate of all participants averaged 97%. The graduation rate for Cohort 1 is 48% with 14% of them still matriculating. The graduation rate for Cohort 2 is 42% with 36% of them still matriculating. Graduation rates for the remaining cohorts were not determined as the majority of these students are still matriculating in the pipeline. Consistently, one-third of the STEM-EP participants have been women of color.

Table 1. Cohort Demographic, Retention, Attrition, and Graduation Data.

	Male Graduates	Female Graduates	Male Attrition	Female Attrition	Males Matriculating	Females Matriculating
Cohort 1	22	13	20	8	8	2
Cohort 2	22	12	12	7	16	13
Cohort 3	3	5	12	7	20	8
Cohort 4	3	4	16	5	54	39
Cohort 5	0	0	5	1	29	12
Cohort 6	0	0	3	1	29	14

Over 95% of the students who participated in STEM-EP enrolled as first-time freshman at PVAMU in the subsequent Fall semester. As shown in Figure 1, of the participants who enrolled at PVAMU, 83% of the participants declared engineering, technology, or computer science as a major, 6% declared mathematics as a major, 4% declared science (chemistry, physics, biology) as a major, and 7% chose other majors.

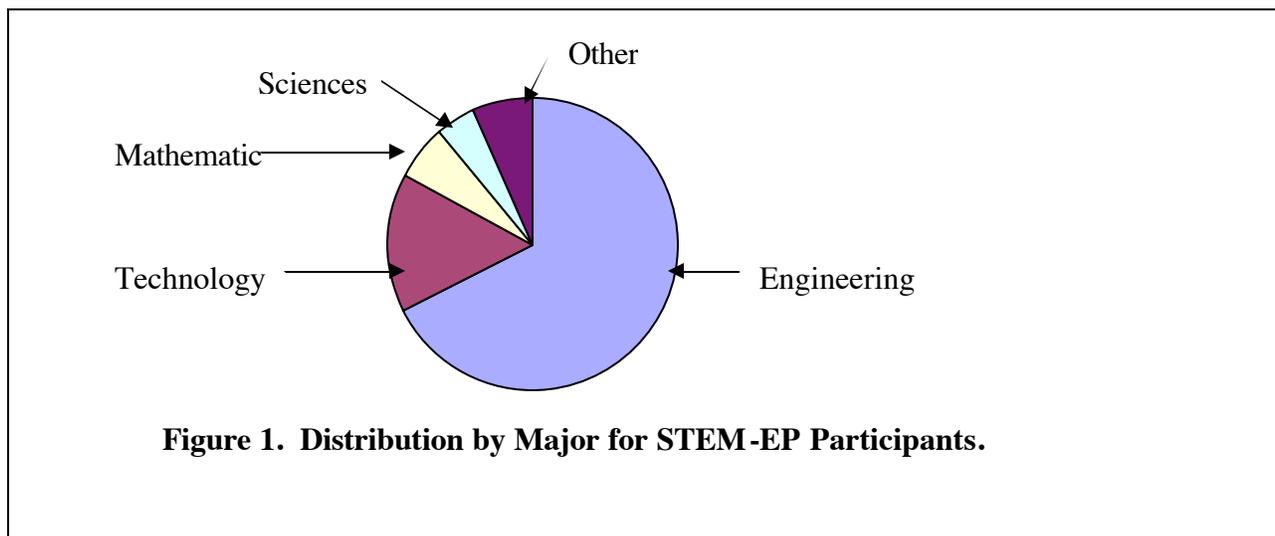


Figure 1. Distribution by Major for STEM-EP Participants.

Moreover, the academic performance of the cohorts was also examined based on the GPA of each cohort after the first academic year. The freshman year GPA average for the six cohorts has been approximately 3.0. The female participants have consistently performed equivalent to or better than the average GPA for the cohort examined as well as their male peers.

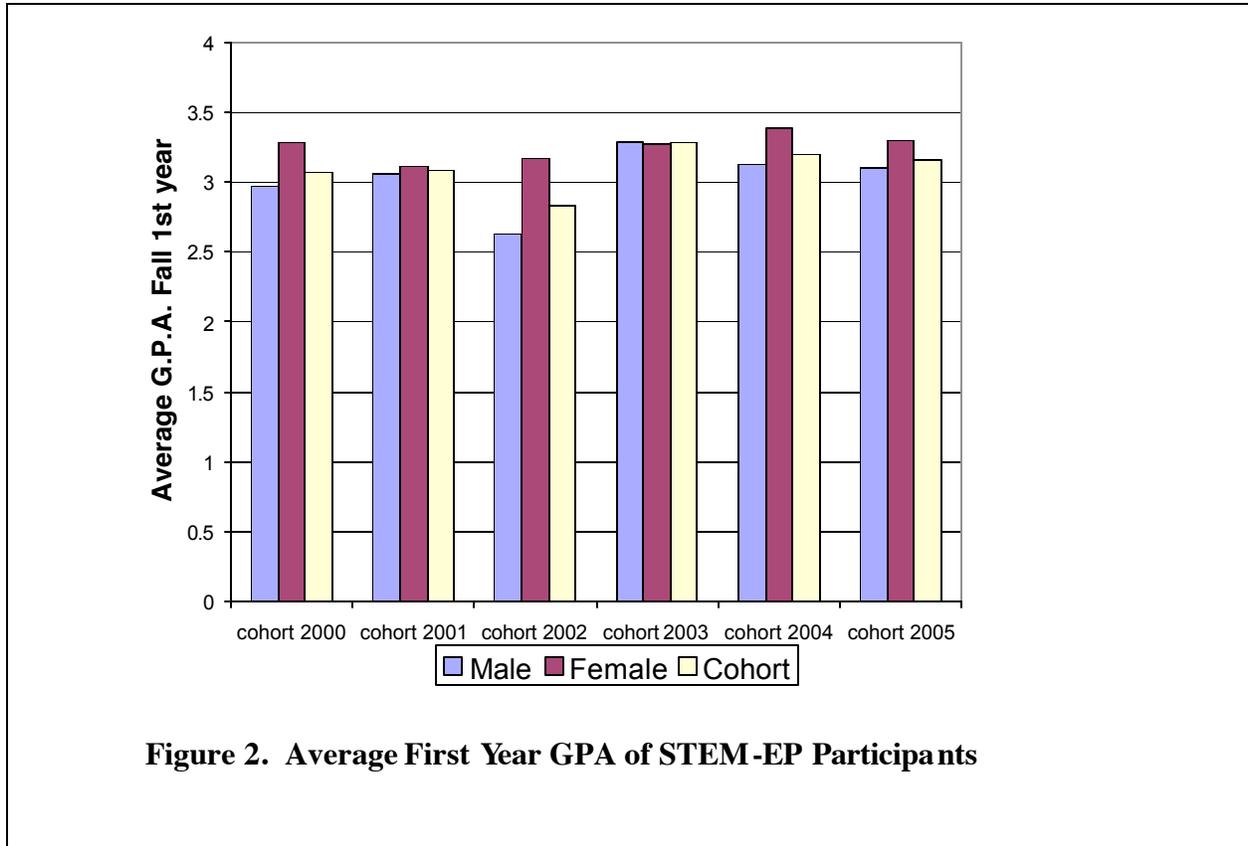


Figure 2. Average First Year GPA of STEM-EP Participants

Lastly, the overall retention rate for each cohort is presented in Figure 3. Retention rate calculations included data for both students who have graduated from a STEM discipline as well as those currently matriculating through the pipeline. Note that the retention rates for the last three cohorts are higher and represent participants who are still early in their academic program. Also, it has been observed that the first two years are the most critical years for retaining students and it is encouraging that Cohorts 2 and 3 still show high retention rates after the sophomore and junior years.

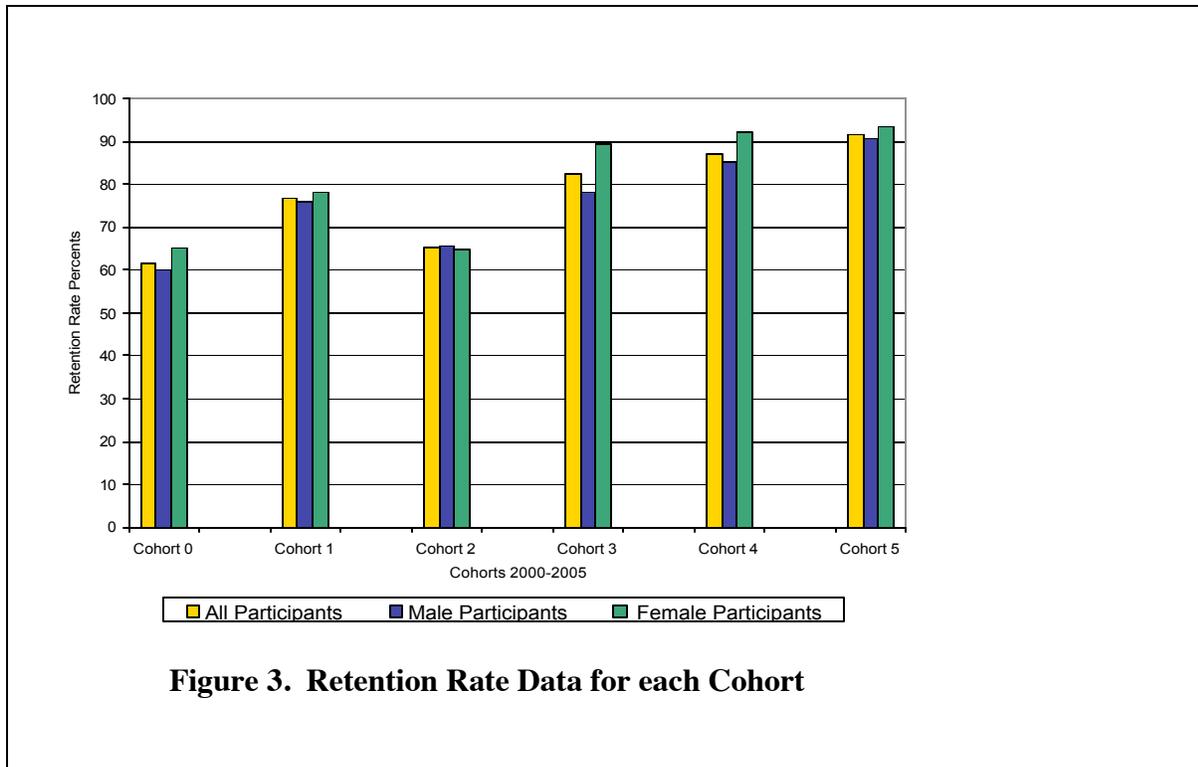


Figure 3. Retention Rate Data for each Cohort

Conclusion and Future Activities

The analysis of the STEM-EP cohort data shows female students performed as well or better than their male counterparts. The program has maintained a relatively high retention rate for both male and female students and STEM-EP has contributed tremendously to the success of their female participants. However, in spite of STEM-EP's success, the authors are presently working on developing additional pipeline programs for the COE. With the overall retention rate of female students in the COE steadily declining from 34% in 2000 to 25% in 2005, there is clearly a strong need to implement more enrichment programs and recruitment efforts targeted to women of color.

References

- Brainard, S., and Carlin, L. (1997). A Longitudinal Study of Undergraduate Women in Engineering and Science. *In Proceedings of 1997 ASEE/IEEE Frontiers in Education Conference.*
- Chubin, D., May, G., and Babco, E. (2005). Diversifying the Engineering Workforce. *Journal of Engineering Education*, January 2005, Vol. 94 No. 1.
- National Science Board. (2006). *Science and Engineering Indicators 2006*. Retrieved February 28, 2006 from nsf.gov.
- National Science Foundation. (2004). NSF Award Abstract #0411541, *STEM Enhancement Program*. Retrieved January 7, 2006 from www.nsf.gov.
- National Science Board. (2000). *Science and Engineering Indicators 2000*. Retrieved February 1, 2006 from nsf.gov.

National Science Foundation. (1999). NSF Award Abstract #9909032, *HBCU: NSF-PVAMU SMET Enhancement Program*. Retrieved January 7, 2006 from www.nsf.gov.

PVAMU. (1999-2003). *PVAMU Fact Book*. Retrieved February 8, 2006 from www.pvamu.edu.

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