Scholars in Engineering: A Scholarship Model for Student Mentoring and Retention

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Abstract

This paper describes a scholarship project, funded by the National Science Foundation to address the significant challenge of retention of students with financial need in engineering at Morgan State University, a public historically black university located in Baltimore, Maryland. Although our university is one of the top producers of underrepresented engineering graduates at the undergraduate level in the United States, our retention and graduate rates are below those of institutions in our state and around the nation. The most widely provided reason by our non-returning students is financial, and includes inability to pay, inadequate aid and level of debt accumulation.

This scholarship program creates a supportive community of undergraduate and graduate scholars in electrical, civil and industrial engineering that is focused on academic achievement. The goals of the Scholars in Engineering program are to 1) cultivate a focus on academic excellence in early-stage bachelor's and master's students, 2) improve student retention and degree completion, 3) enhance student retention and support programs in the school of engineering, 4) improve graduate school or career preparation and placement. The student community is cultivated through academic monitoring, mentoring, professional development and community building activities. Two kinds of mentoring relationships are encouraged; peer mentoring between the graduate and undergraduate students and hierarchical mentoring between faculty and graduate students to support community building, encourage academic excellence and increase career preparation. The program involves two cohorts of approximately 11 undergraduates each and five cohorts of about four graduate students each. In addition to financial need and citizenship criteria, other selection factors include academic performance, motivation, and calculus I enrollment (undergraduates).

This paper will describe the implementation of the project and the results from the first three semesters of cohort 1 that started the program in fall 2010.

Background

Morgan State University (MSU or Morgan) is a public historically black university (HBCU) located in Baltimore, Maryland and classified as a doctoral/research university under the Carnegie classification system. The mission of the university is to serve populations that may not normally have access to higher education. The 8,000 member student body is about 92% African American and represents varying academic and socio-economic backgrounds from Maryland, the United States and foreign countries. The School of Engineering at Morgan State University has maintained a commitment to increasing the representation of male and female African Americans in engineering. Statistics on graduation attest to the progress that we have made and

our national leadership role in the production of women and minority engineers. In the 2006-2007 academic year, we led the nation in the percentage of bachelor's degrees awarded to women by a school of engineering with 42.6% (ASEE, 2007). In 2008, the School of Engineering was ranked 6th in the number of B.S. degrees in engineering awarded to African Americans and 8th in the percentage of bachelor's degrees awarded to women (ASEE, 2008). Our current accomplishments in this area, while noteworthy, are insufficient to address the technology-related labor needs of the State of Maryland or the United States. The final report, *Investing in STEM to Secure Maryland's Future*, of a task forced commissioned by the governor of Maryland calls for a 40% increase in the number of STEM college graduates by 2015 (Governor's, 2009).

Many factors contribute to student retention in engineering and at the university. The Fall 2008 survey of Fall 2007 first year students who did not return cited financial, institutional, academic and personal reasons for leaving the university. The most cited reason for not returning to the university was financial. About 41% of respondents cited the inability to pay tuition as the main reason for not returning. Other financial reasons included inadequate financial aid and level of debt required to continue at MSU. The statistics on financial awards at the university indicate the extent of need. The estimated cost of attendance in the 2008 – 2009 academic year ranged from $14,500 for undergraduate Maryland residents to $24,000 to out-of-state graduate students with almost half of the amount from tuition. In 2007, a quarter of the university financial awards went to students with an expected financial contribution (EFC) of $0. The financial burden impacts student academic performance, retention and graduation. The average retention rate for African Americans in the State of Maryland in 2007 was 69.7%. From 2003 to 2006, the average university retention rate for first-year students was 67.2%. The average retention in the School of Engineering was higher at 79%. The 2007 African American graduation rate for the State of Maryland is 44.7%. The six year graduation rate for five periods ranging from 1998-2004 to 2002-2008 for the university and the School of Engineering were 36.08% (MSU is ranked 13th compared to 37 HBCUs) and 35.30% respectively.

The primary goal of this scholarship program is to improve student retention and degree completion by focusing on academic excellence and professional development. It extends a peer interaction model developed for first-year students (Mack, 2002),

Program Description

The Scholars in Engineering (SiE) program was initiated in the fall 2010 semester. The program goals were designed to be achieved through academic monitoring, mentoring, professional development and community building activities described below. Financial awards were provided to undergraduate and graduate participants of up to $4,500 and $9,000 respectively. These awards were designed to reduce the debt burden, not provide the full cost of attendance. Figure 1 depicts the components of the model for this scholarship. The academic and professional development of the student was enhanced by the interaction of the School of Engineering, an industry and the scholarship program.

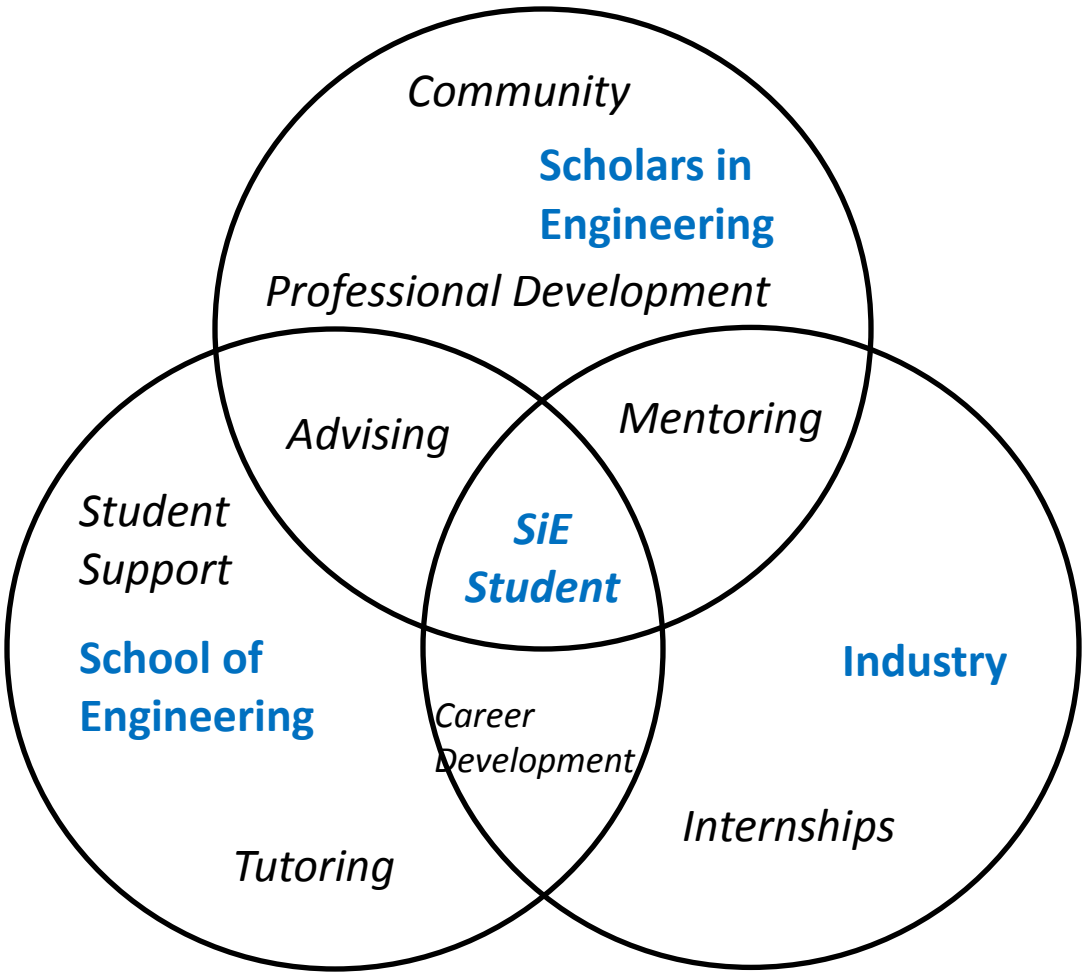

Figure 1: Scholarship Model

1. Academic Advising and Monitoring: Upon acceptance into the program, undergraduate students receive preliminary academic advising from their department including course load, course selection and requirements for degree completion. Graduate students are advised by their respective graduate adviser. In order to develop an academic achievement culture, students are provided with strategies for successful academic performance and monitored at two points each semester; at the start of the semester and at mid-terms.

2. Mentoring: The mentoring activities are designed to support persistence to graduation and to develop a relationship with a person who has experience at the next career stage. Each undergraduate participant is matched with a graduate student mentor. The undergraduate student is expected to gain appreciation for the expectations, excitement and challenges of graduate school based on their interactions with the graduate students. Graduate students are mentored through their departmental faculty. Each department has students assigned to an adviser under whom they will conduct their research. Mentoring is also provided in partnership with industry.

3. Professional Development: Activities for SiE students are selected to support student academic success while at Morgan, and to prepare them for graduate school or the workforce. At least two workshops are available each semester around four themes; Personal Development, Career Planning, Graduate School and Communication.

4. Community Building: Activities and interactions are structured to encourage interaction and a sense of community. These include monthly meetings and informal gatherings.

Participant Recruitment, Selection and Profile

Current first and second-year undergraduate engineering students and newly admitted students enrolled in Calculus I, or higher, were eligible to apply for a SiE scholarship. Incoming graduate students and those in their first semester were also able to apply. The selection criteria included major, citizenship, academic performance, motivation and financial need as detailed in Table 1. Students submitted letters of recommendation from faculty and a personal statement to gauge motivation and potential for academic success. The scholarship was advertised to all engineering faculty, students who met the GPA eligibility and through the student employment office.

Table 1: Program Eligibility and Application Process for Undergraduate and Graduate Students

Program Eligibility: Undergraduate Students 1) Major: Within School of Engineering 2) Citizenship: United States citizens, U.S. Permanent residents, United States Nationals, and Refugees 3) Academics: a) Full-time first or second year undergraduate student b) Have a minimum cumulative GPA of 2.5 c) Must be enrolled in at least Math241 (Calculus 1) when scholarship period begins.	Application Documents: Undergraduate Students 1) Personal statement that provides evidence of academic drive, career goals and explains why you should be selected for the scholarship. 2) One letter of recommendation from MSU faculty (ideally, from School of Engineering faculty) 3) Demonstrate eligibility for need-based financial aid as determined by MSU Financial Aid Department (students with full scholarships should not apply) 4) Supporting documents (transcript, resume, proof of permanent residence, etc.)
Program Eligibility: Graduate Students 1) Major: Within School of Engineering 2) Citizenship: United States citizens, U.S. Permanent residents, United States Nationals, and Refugees 3) Academics: a) Full-time Masters student b) Must have graduate GPA of 3.3. Incoming graduate students with a minimum undergraduate GPA of 3.5 will be considered	Application Documents: Graduate Students 1) Submit a personal statement that provides evidence of academic drive, career goals, mentoring experience and explains why you should be selected for the scholarship. 2) Two letters of recommendation from MSU School of Engineering faculty 3) Demonstrate eligibility for need-based financial aid as determined by MSU Financial Aid Department 4) Supporting documents (transcript, resume, proof of permanent residence, etc.)

Current students submitted their applications during the spring 2010 semester. Incoming students applied prior to the start of the fall 2010 semester. The number of eligible applications received and program participants selected are shown in Table 2. The undergraduate and graduate scholarship participants in the first cohort were 35% female and 20% female respectively. The percentage of female participants significantly exceeds that in the School of Engineering for undergraduate students only.

Table 2: Gender of Applicants and Participants for Cohort 1

	Applied		Eligible		Selected		School of Engineering	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Undergraduate	21 (70%)	9 (30%)	19 (74%)	7 (26%)	7 (65%)	4 (35%)	575 76%	181 24%
Graduate	8 (80%)	2 (20%)	4 (80%)	1 (20%)	3 (75%)	1 (25%)	75 76%	23 24%

Table 3 contains a more detailed profile of the SiE participants. The average grade point average for the current undergraduate students was above 3.6/4.0 and that for current graduate students was 0.3 points lower. About 75% of all the participants were US citizens and Maryland residents. The African American population of the scholarship recipients compared to the School of Engineering is about the same for undergraduates, but significantly more for graduate students. The average award students received was about 40% of the unmet need after Pell and institutional grants. Other university awards and Federal loans provided additional funds. Tuition for graduate students was provided through an institutional award.

Table 3: Profile of SiE Participants

	Undergraduate	**Graduate**
Number of Students	11	5[1]
Average GPA	3.634	3.385[2]
US Citizens	82%	60%
MD Resident	82%	80%
African American	82%	100%
Gender	7 male, 4 female	4 male, 1 female
Average Unmet Need	$11,555	$22,437
Average Award	$4,886	$9,250

Program Implementation

1. Academic Advising and Monitoring: Prior to the start of each semester, the performance of SiE students during the previous academic semester is reviewed for courses which resulted in incomplete and failing grades. In addition, if the semester GPA for undergraduate participants is less than a 2.8, they are put on a probationary status and

[1] One student is not funded by NSF but chose to participate in activities.

[2] Graduate GPA for returning students only (n=2).

provided with a recommended academic improvement plan that takes advantage of academic support resources. Graduate students who earn a GPA lower than 3.3 are required to develop an academic improvement plan. After midterm grades become available, student performance is reviewed and students with poor performance are provided with recommended corrective action. During the first three semesters, four undergraduate students have been placed on probation resulting from cumulative GPAs less than 3.25 (Figure 2). For most of these students, the drop in performance was either a result of poor time management as the number of engineering courses and credit load increased or the inability to seek psychological support especially during periods of significant changes in their personal lives. All of these students have improved their GPA in the subsequent semester except one. The graduate students have improved their cumulative GPA each semester as shown in Figure 3.

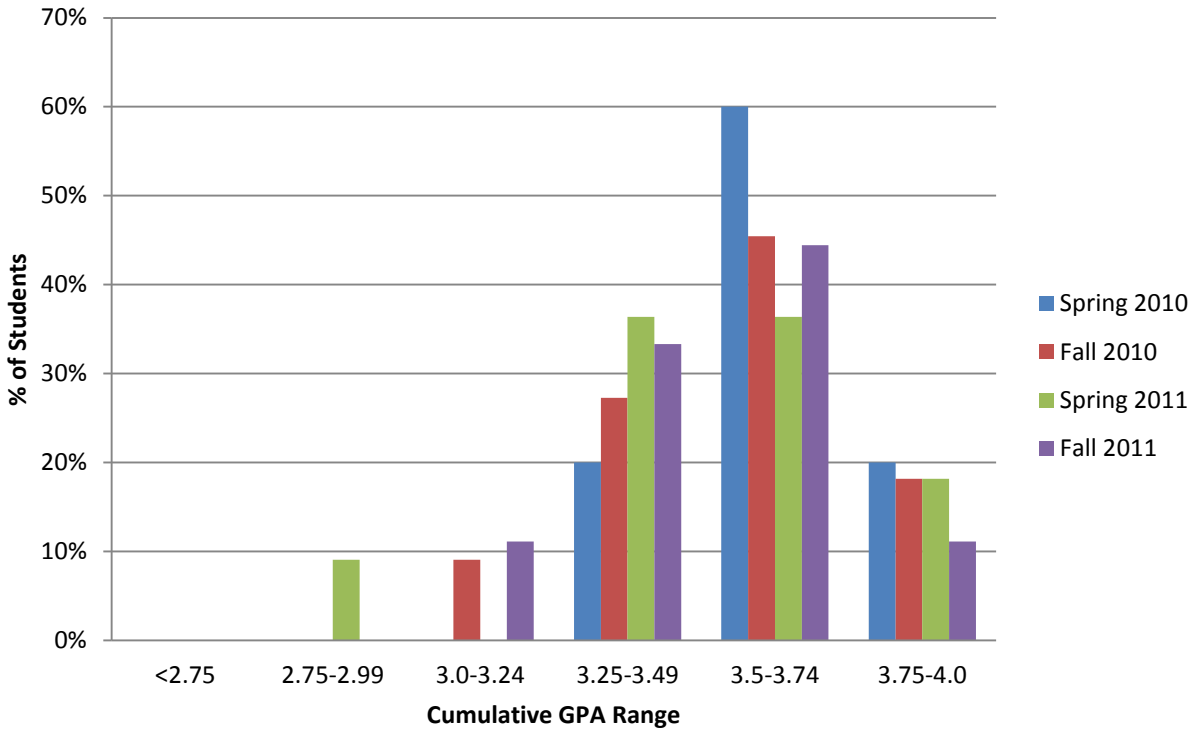

Figure 2: Undergraduate Student Academic Performance by Semester

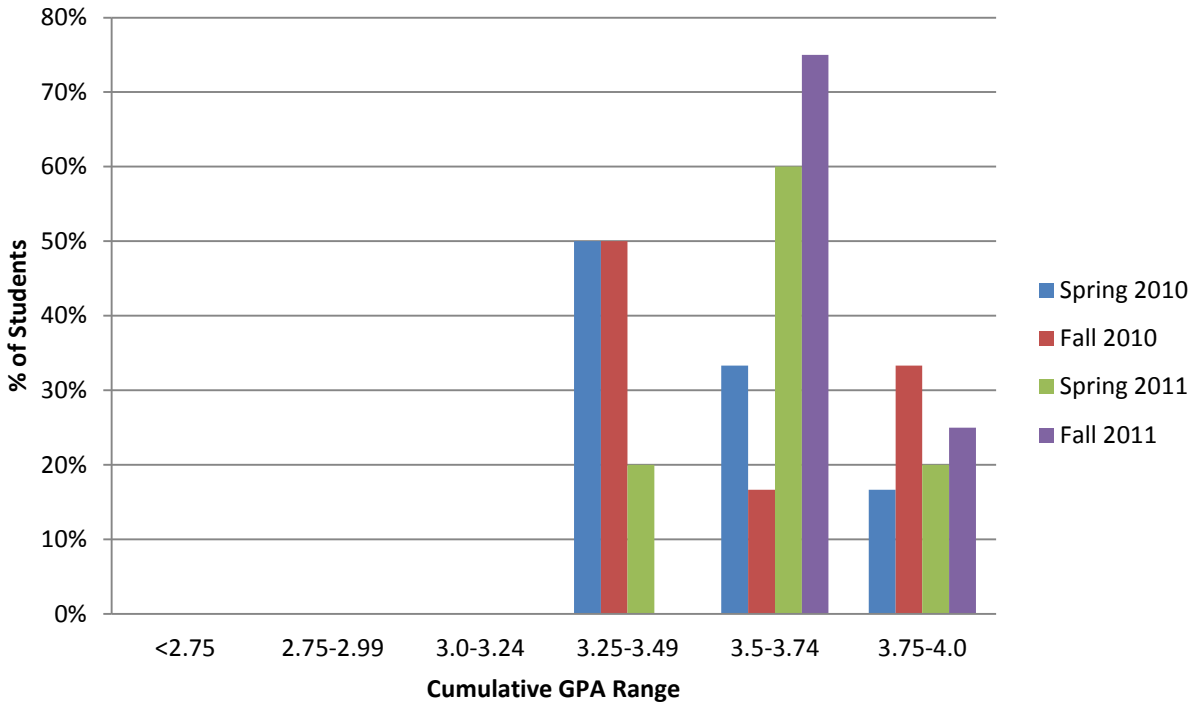

Figure 3: Graduate Student Academic Performance by Semester

2. Mentoring: The first week of each semester, SiE student participants meet to discuss the performance expectations for the semester. Strategies for academic success and techniques to maintain an effective mentoring relationship are also discussed. Each undergraduate student was matched with a graduate SiE mentor and the graduate student was mentored by their research adviser. The relationship was left with some flexibility to adapt to students' styles. Almost every student communicated with their mentor at least once every two weeks. Additionally, the students were matched with a mentor in industry with whom they communicated about once a month. The industry mentor provided insight that on corporate engineering from a minority perspective. The relationship with the industry mentor varied by student.

3. Professional Development: Activities for SiE students are selected to support student academic success while at Morgan, and to prepare them for graduate school or the workforce.
    a. Goal Setting: At the beginning of each semester, students set academic and personal goals which they are encouraged to post in a visible place. More than half of the students (56%) reported posting these goals. At the end of the semester, they reflect on the goals and what factors impacted their ability to achieve these goals.
    b. Internships: The coordinator for student work experience provided a workshop for students on applying for internships and research experiences. Additionally, information on security clearances was provided. Internship strategies were also discussed during monthly meetings. Over 85% of the students obtained

internships or a research positions with corporations or the government.

c. Time Management: Based on undergraduate student performance, students were provided with stress and time management strategies.

4. Community Building: Activities and interactions are structured to encourage interaction and a sense of community. Activities at the first meeting each semester and throughout the semester were designed for students to learn more about each other and foster a sense of community. These included ice breakers, exam week pizza party and a pot luck.

Program Evaluation

The evaluation criteria are the goals of the Scholars in Engineering program.

1) Cultivate a focus on academic excellence in early-stage bachelor's and master's students: While students developed and monitored goals, only 63% of participants maintained or increased their grade point averages. Time management activities are being developed to address these needs.

2) Improve student retention and degree completion: All the initial cohort has remained in STEM or graduated, except for one student who transferred to another university. This speaks to the impact of the program on student performance given six year graduation rates of 36%.

3) Enhance student retention and support programs in the school of engineering: Almost 90% of the students maintained contact with their peer mentor at least once every two weeks and only one student has been unable to maintain satisfactory academic performance.

4) Improve graduate school or career preparation and placement: Most students utilized the career related workshops and fairs (70%) and discussed career choices with their industrial mentor, resulting in 88% of students obtaining engineering-related summer opportunities.

Acknowledgements

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