Success Expectations of Low-Income Academically Talented Students in Engineering - a Preliminary Study at a Hispanic-Serving Institution

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Success Expectations of Low-Income Academically Talented Students in Engineering - A Preliminary Study at a Hispanic-Serving Institution

Introduction

This paper describes findings on interviews conducted with Hispanic engineering students interested in participating in an S-STEM fellowship program at the University of Puerto Rico, Mayagüez Campus (UPRM). The program seeks to increase the retention, persistence, and success of Low-Income Academically Talented Students (LIATS) at the College of Engineering (CoE). The College of Engineering (CoE) graduation rates for 2015 at our Hispanic Serving Institution revealed to be 73% for students from households with income above $50,000/year, and 54% from households with income below $7,500/year. Similar trends were also noticed in retention and persistence rates indicating higher attrition among students from lower income families. This program aims to increase these statistics among LIATS by integrating elements from Lent's et al. Social Cognitive Career Theory [1] [2] and Tinto's Departure Model [3][4] in conjunction with a scholarship program. The final objective is to establish an intervention model to be further institutionalized in the CoE, if proven to be effective [5][6]. In this program we have included tools to reinforce not only academic performance and faculty mentoring, but also included extra-curricular activities, peer group support interactions, and research/work experiences for all participating students. Participation is completely voluntary and in accordance to IRB protocol approvals.

Specifically, this paper focuses on findings of an exploratory study conducted during the recruitment and selection process of participants. The study was guided by the following research question: What are the success expectations of LIATS participating in the proposed fellowship program? Results from the exploratory study helped in the selection of activities that were included as part of our proposed model.

Recruitment and Selection

The program student selection process consisted of five stages: announcement, application, info-session, interviews, and awarding. All BS students from 1st to 3rd year, plus all 1st-year MS students in the College of Engineering were invited to apply to the program during the announcement stage. A total of 2,388 students received information about the program and how to apply. The application stage began when the on-line application process was opened, which resulted in 871 applications received. All applicants were invited to an informative session. A total of 628 students attended the info session and were asked to provide complementary application information. From the total attendees, 564 provided the information required to continue the selection process. All completed expedients were analyzed for economic need, academic performance, and extracurricular activities and ranked top-down. Participants were qualified by our registrar's office as academically talented and by the student affairs office with economical need. These were the two requirements to participate in the program as established by the NSF S-STEM program. As the project provided for 43 scholarships, plus an equal number of participants without economic support, we aimed at interviewing at least 129 top qualified applicants. As a result of various equal scores, we cited a total of 136 students for

interviews. From those, 110 attended the interview process. Ninety-two were selected to join the program: 41 with scholarships (S) and 51 as participants (P) without economic support.

The cohort included 34 first-year students (S=13, P=21), 28 sophomores (S=13, P=15), 28 juniors (S=13, P=15), and two grads (S=2, P=0). From the 110 applicants interviewed, 51 were selected to join the program as participants. Participant students receive all program benefits except program financial aid. This group allowed us to establish a control study group to assess the impact of early interventions beyond that economic aid.

The demographic distribution of participants was further analyzed in terms of gender, year of study, school of origin, household income, and program of study. The proportion of female to male students is 43% to 57% denoting a balanced gender blend. The College of engineering has 26% female proportion across all engineering disciplines. In the scholars group, the female proportion is unusually high, with 61%. During the recruitment process, although gender was not a selection criteria, the response received from highly ranked females to complete questionnaires and attend meetings and interviews was markedly higher than that of males. Refer to Figure 1.

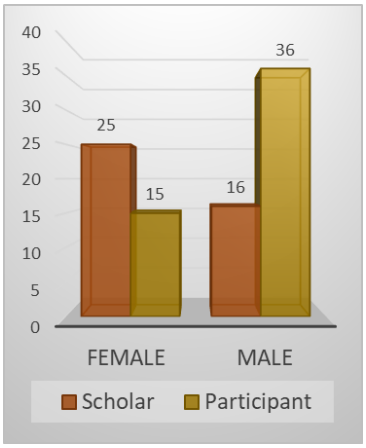

Figure 1. Gender Distribution

The year of study of participant and scholar groups is by design balanced to have approximately the same proportion for all undergraduates. The number of first-year students was skewed to 37% to account for potential desertions up to 20% in this group and still end up with a balanced number of students in each group. In the case of graduate students, the number of applications was significantly smaller than anticipated. Only two graduate participants could be recruited and only 50% of available graduate scholarship slots were occupied. Refer to Figure 2.

The school of origin refers to whether the student came from a private or public high school. Although in both groups, participants and scholars, students predominantly come from public schools, among scholars the balance of public school students outweighs 83% to 17% those in the participants group. Figure 3 lists the numbers for each group.

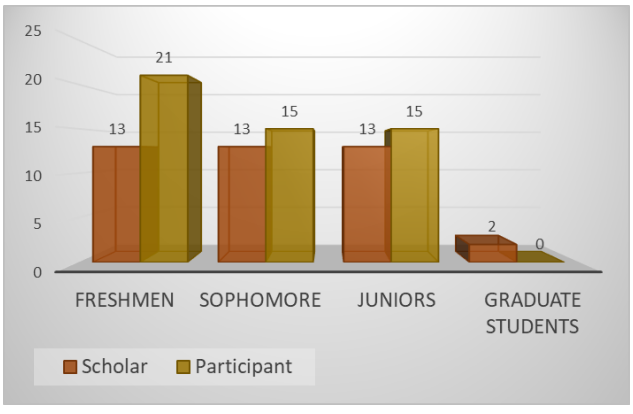

Figure 2. Academic Level

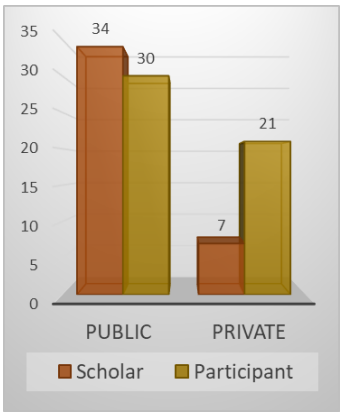

Figure 3 – School of Origin

The weighted yearly average household income of scholarship recipients calculated using the number of students in a particular income bracket is below $14,512. For participants, the average is $44,216. This difference responds to the fact that economic need was the heaviest factor in the scholar selection criteria. Figure 4 below provides detailed information on the household income of both groups.

The proposed program includes students from all undergraduate programs offered in the College of Engineering. Although upon entry, students were balanced by department size, during the first year, 5% of the students changed study program.

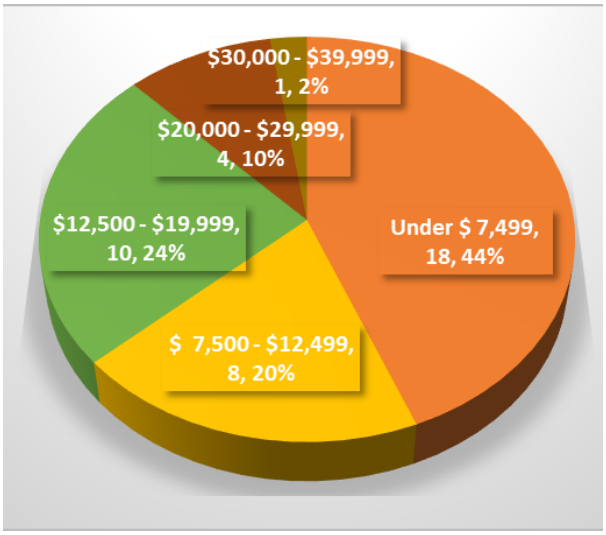

Figure 4 – Yearly Household Income

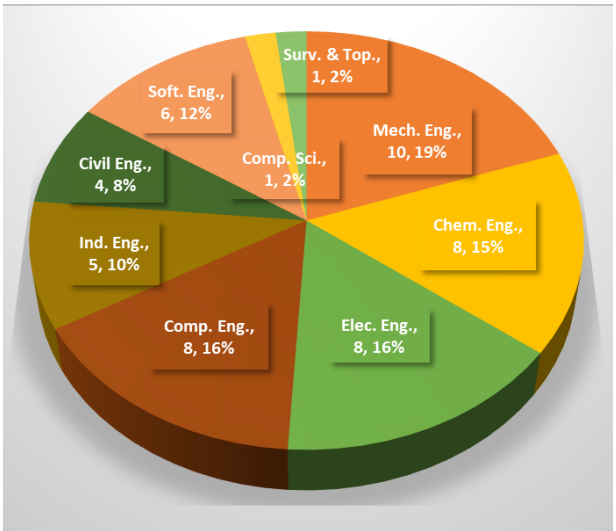

Figure 5 – Academic Program Distribution

In the following sections we present results obtained from the interview process.

Interviews

The interview protocol consisted of questions that focused on: (1) motivation in pursuing an engineering degree, (2) likes and dislikes on their current program of study, (3) factors affecting academic performance, (4) plans after graduation, (5) events that had an adverse effect on academic performance, and (6) interest in participating. A total of six questions were asked to the students.

1. What was your motivation to study engineering?
2. So far, what do you consider to be what you liked and disliked most about your program of study?
3. Are you currently facing any situation that could affect your academic performance or prevent you from continuing your studies?
4. Do you have any plans for after you graduate?
5. Tell me about a situation where you feel that your academic performance has not been the best. When did it occurred? What did you do about it? Would you have done something different?
6. Why are you interested in being part of this program?

Results

A grounded theory approach was applied to determine emerging themes through an open-coding process. Grounded theory establishes that theory can be generated according to data that has been collected and analyzed following a predetermined process.[7] Once data were analyzed and emerging themes were identified, participants' answers were tallied and ranked accordingly. Results and discussion for each question are presented below.

Q1: Motivation in pursuing an engineering degree. Results indicated that students' interest to pursue an engineering degree was due primarily to a desire to fulfill an interest in science and engineering and to participate on a campus outreach activity, such as summer camps, science clubs, etc. The least impact was due to being motivated by a family member or teacher. Refer to Table 6 for details.

Table 6. Tally of results for Q1.

Emerging Themes	Scholar	Participant	Total
Interest in engineering and science in general	16	14	30
Participation in campus outreach activities	10	19	29
High school course	4	5	9
Desire to make a difference	6	3	9
Motivated by family member	0	7	7
High school teacher	3	2	5
Total	39	50	89

Q2: Likes and dislikes on current program of study. The findings indicated a positive reaction to the college environment and courses approved from their plan of study. Although most students responded by saying that they do not have dislikes, those who did disliked the college workload and the difficulty of courses in comparison to their high school experiences. Also, college policies and the burden to comply was also noted as a dislike in their programs. Refer to Table 7.

Q3: Factors affecting academic performance. When asked about factors affecting their academic performance, participants indicated it was mostly due to economic problems they were facing due to rising tuition costs. It is important to clarify that after having conducted these interviews, the tuition costs doubled. Therefore the relevance of providing financial aid to students is even greater. Refer to Table 8.

Q4: Plans after graduation. As for the plans after graduation, students indicated a preference to continue graduate studies, followed by entering the workforce or a combination of both (work and studies). Refer to Table 9.

Table 7. Tally of results for Q2.

	Emerging Themes (Likes and Dislikes)	Scholar	Participant	Total
Likes	College environment	5	18	30
	Courses taken	13	12	29
	New skills developed	2	4	9
	Participation in research or project	6	5	9
	Feels challenged	3	4	7
	Hands on experiences	9	6	5
	Total Likes	39	50	89
Dislikes	None	10	12	22
	Work-load compared to HS	6	11	17
	Courses taken	7	8	15
	School policies and program	7	6	13
	Being far from home	5	3	8
	Teaching methods of some professors	2	2	4
	Uncertainty after graduation	0	4	4
	Total Dislikes	39	50	89

Table 8. Tally of results for Q3.

Emerging Themes	Scholar	Participant	Total
Economic problems due to the rise of school tuition fees	22	19	41
None	9	16	25
Personal problems	4	7	11
Workload balance	2	8	10
Language barrier	2	0	2
Total	39	50	89

Table 9. Tally of results for Q4.

Emerging Themes	Scholar	Participant	Total
Graduate School	17	15	32
Work	13	16	29
Work and Graduate School (at the same time)	8	13	21
None in particular	0	5	5
Own a Business	1	1	2
Total	39	50	89

Q5: Events that had an adverse effect on academic performance. Regarding the activities that have adversely affected academic achievement, interviewees indicated that time management had the greatest effect. This is why among the staff that support the project we have a professional counselor who helps them organize their time by creating individualized plans. Surprisingly, the effects of Hurricane María were in third position, almost even with the answer that no activity has affected them academically. Refer to Table 10.

Table 10. Tally of results for Q5.

Emerging Themes	Scholar	Participant	Total
Time management	12	12	24
None	9	4	13
Hurricane María	5	7	12
Extracurricular Activities	1	8	9
Personal Problems	3	5	8
Education from HS	1	6	7
Course	2	4	6
Taking exams	2	1	3
Problem with professor	1	2	3
Workload	2	1	3
Group Project	1	0	1
Total	39	50	89

Q6: Interest in participating. Finally, in terms of their interest in participating in this program, respondents indicated the need to have a mentor to guide them during their years of study as a primary reason. Then the opportunity to participate in a COOP or internships experience as a second option. Finally, receiving financial aid was in third position. Refer to Table 11.

Table 11. Tally of results for Q6.

Emerging Themes	Scholar	Participant	Total
Mentorship	7	18	25
Coop/Internship Experience	7	4	11
Scholarship	1	4	5
Total	3	4	43

Conclusions and Implications

The answers provided by the participants allowed us to answer the research question. It was established at the beginning of this paper as: What are the success expectations of LIATS

participating in the proposed fellowship program? These expectations can be summarized as follows.

- Obtain an engineering degree due to previous participation on a campus outreach activity, such as summer camps, science clubs.
- Participate actively on curricular and extracurricular activities since they enjoy college environment and courses included in their plan of study.
- Receive additional financial aid, which will reduce the burden of economic problems and consequently, its negative effect on their academic performance.
- Opportunity to be better prepared to continue graduate studies or enter the workforce.
- Have a mentor to guide them during their years of study.

As a result, several activities have been established for the first year of this project. These include and are not limited to interactions with mentors, professional training activities, courses that have been developed to ensure student success, motivational talks, and social activities, among others. These findings are well aligned to other activities identified on other S-STEM initiatives.[8][9][10][11]

To measure the impact of the proposed activities among participants, questionnaires are sent semiannually to students. Results are discussed by the project's executive board, faculty mentors, and university administrators. These interactions allowed us to identify changes to be made in the project activities that will foster students' retention as we progress. Likewise, we identify events that adversely affect them that are beyond our control, to offer the necessary help and thus increase the possibility of student to successfully obtain his or her academic degree.

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