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Perceptions of low-income and academically talented students and mentors of [Program Name] - an S-STEM program at a Hispanic Serving Institution

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Perceptions of low-income and academically talented students and mentors of the PEARLS program – an S-STEM program at UPRM

Introduction

The Program for Engineering Access, Retention, and LIATS Success (PEARLS) is a structured scholarship program designed to mitigate the economic hardship associated with the cost of attendance (COA) at the University of Puerto Rico Mayagüez Campus (UPRM). The main goal of PEARLS is to increase the retention and success of low-income, academically talented students (LIATS) in engineering programs at a Hispanic institution. Traditionally, at the college level, students from lower socioeconomic status have higher attrition levels, significantly lower retention and persistence rates, and higher time to graduation rates.[1][2] The program's indicator of long-term success (longitudinal data) includes persistence, time to graduation, on-time graduation, graduation rates, and successful insertion into graduate school or the engineering workforce. To achieve this, we structured students' interventions around a theoretical model named the LIAT College Access and Success model (L-CAS), which combines Social Cognitive Career Theory [3][4] and Tinto's Departure Model [5][6]. The model is divided into five stages: LIATS Background Experiences, Belonging, Formative, Growth, and Graduate Development. (Refer to Figure 1).

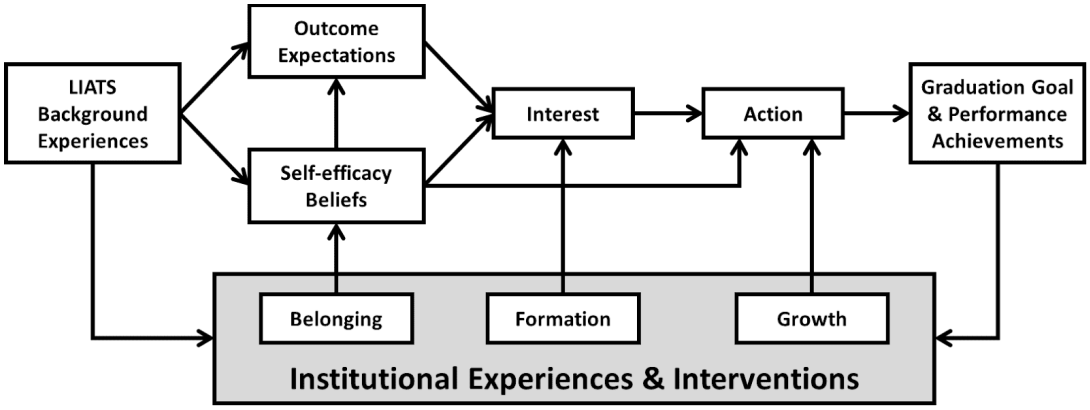

Figure 1: Representation of the L-CAS model [7].

This paper presents the program evaluation results of the project jointly with a scholarship program to establish an intervention model to be further institutionalized at the CoE if proven to be effective [8][9]. The goal of the PEARLS is to achieve the following objectives:

- 85% of the participants remain in their CoE program until graduation.
- 85% of the participants maintain their status as scholars for the award extension.
- 80% of participants complete their degrees in less than 6.5 years.
- 85% of participants will enter the workforce or continue into graduate school within a year after graduation.

Evaluation Design

We used a descriptive design to assess the implementation of the different activities of the program. The data was analyzed using descriptive statistics. The questions that guided this evaluation were:

- What activities impacted students and mentors?
- According to mentors and students, what were the strengths and weaknesses of the mentoring program?

Data Collection Method:

We used electronic self-report questionnaires, direct observation, and official documents for data collection. At the end of the program's first year, we sent an invitation and link to access an electronic version of a questionnaire using Survey Monkey Platform to the students and mentors participating in the program. The invitation message indicated the purpose of the survey and the importance of participating in the assessment process. After three electronic messages, follow-up, and one personal remainder, the link to access the questionnaires was closed. The data collection activities used were:

- Annual Assessment Questionnaire for Students: a self-report questionnaire completed by students.
- Annual Assessment Questionnaire for Mentors: a self-report questionnaire completed by faculty mentors participating in the program.
- Official Program Documentation: grant proposal submitted to NSF, courses syllabus, program webpage, Individual Development Plan (IDP), CRM, Scholar Selection and Continuity Criteria Protocol, IRB Consent Form, and meeting minutes, among others.
- Direct Observations during project team meetings, workshops, and co-curricular activities.

Sample Description and Sample Size

The population for the assessment consisted of trainees and mentors participating in PEARLS in years one and two (2018-19 and 2019-20 academic years), respectively. Participation in the assessment process was voluntary. A complete description of the selection process followed in this study is provided in [10].

Trainees Population:

During the first year, the population of PEARLS consisted of ninety-two (92) LIATS, 40 females and 52 males, in eight engineering programs at UPRM. These ninety-two students met the eligibility criteria and the selection process established by the program.[10] There were four levels of participation among the participants: 28 students received a scholarship (Scholar), 13 students received a scholarship and tuition waiver (Scholar with Waiver), 13 students received a tuition waiver (Waiver), and 38 students participated in activities without any economic support (Participant). At the end of the first year, there were 91 students; one student dropped out of the program.

During the second year of the program, one (1) student from the Mechanical Engineering Department joined the program as a Participant with the expectation of receiving a scholarship soon. However, he decided to drop the program because the multiple activities took time away

from other academic activities. A second female Participant transferred from Civil Engineering to the Psychology program. A third male Participant moved from Surveying & Topography to Mechanical Engineering. He showed a low academic performance starting from the first year in the program. Then he decided to stop participating in activities and left the program. Finally, a graduate student lost scholarship eligibility as she accepted a full-time job offer. The graduate scholarships offered are equivalent to only a half-time assistantship, which is not attractive for most graduate students. The rationale behind a Scholarship is that the candidate is a full-time student and, therefore, should be wholly committed to the academic work and focused on completing the degree with a good performance within the expected time according to the academic program they are enrolled in. In summary, at the end of the second year (May 2020), there were four (4) fewer students in the program, three (3) Participants, and one (1) Scholar. Therefore, the population of trainees participating in the external evaluation for the second year was eighty-eight (88) LIATS, 39 females and 49 males.

During the first year of the program, there were four levels of participation: 1) students that received a scholarship only, 2) students that received a scholarship and tuition waiver, 3) students that received tuition waiver; and 4) students that participated in activities without any economic support. However, during the second year, only two levels of participation remained: 1) Scholars and Participants. There were forty-seven (47) participants and forty-one (41) Scholars. Refer to Table 1 for a summary of these results.

Table 1. Distribution of Participants for years 1 and 2.

Classification	Year 1	Year 2
Female	40	39
Male	52	49
Scholars	41	41
With Tuition Waiver (SW)	28	-
Without Tuition Waiver (S)	13	41
Participants	51	47
With Tuition Waiver (W)	38	-
Without Tuition Waiver (P)	13	47
Total	92	88

Sample of Trainees

During the first year, 72 of the 92 trainees (response rate of 78.32%) voluntarily completed the Annual Assessment Questionnaire for Students. However, not all participants completed the entire questionnaire. The distribution of these 72 students by level of participation was as follows: 56.94% (n = 52) with financial aid (S, SW, or W) and 43.06% (n = 40) participants (P). In the second year, 84 of the 88 trainees voluntarily completed the Annual Assessment Questionnaire for Students with a response rate of 95.45%. The distribution of these 84 students by level of participation was as follows: 54.76% (n = 46) Scholars, and 45.24% (n = 38) Participants. In the

assessment study, the response rate was slightly higher among those who received financial aid (97.87%; 46 out of 47) than participants who did not receive financial aid (92.68%; 38 out of 41).

Mentors: Population and Sample

There were seven mentors, from different engineering programs, during the first year and eight mentors in the second year. We could not identify a mentor from the Software Engineering and Computer Science programs; thus, the Computer Engineering mentor assisted students in these programs due to their commonalities in course requirements. Also, three of eight mentors (38%) are females who served students from the Computer Engineering, Industrial Engineering, and Civil Engineering and Surveying departments. Five (63%) had previous mentoring experiences in other students' training program initiatives. Table 2 details the mentor/mentee distribution for Years 1 and 2. The response rate of mentors for the Annual Assessment Questionnaire was 100% for the first year and 88% (n = 7) in the second year.

Table 2. Mentor/Mentee Distribution for Years 1 and 2.

Mentor	Gender	Department	Year 1	Year 2
Mentor 1	Male	Graduate Students	2	3
Mentor 2	Male	Mechanical Engineering	16	15
Mentor 3	Male	Electrical Engineering	19	12
Mentor 4	Male	Chemical Engineering	15	15
Mentor 5	Female	Computer Engineering	19	11
Mentor 6	Male	Software Engineering and Computer Science		13
Mentor 7	Female	Industrial Engineering	12	11
Mentor 8	Female	Civil Engineering and Surveying	9	8
		Total	92	88

Assessment Results

The L-CAS model is structured in five stages: LIATS Background Experiences, Belonging, Formative, Growth, and Graduate Development. The results presented include only four of the five stages. We considered the first stage of the project, LIATS Background Experiences, for participant selection and other research analyses. In addition, we evaluated the mentoring components of the PEARLS program. The results presented in this section focus on students' and mentors' perspectives of the mentoring program established.

According to their engineering field, the program assigns LIATS to faculty mentors. The goal is to promote a sense of belonging during their years of study. Mentors are valuable in fostering academic and work experiences for trainees and supporting them to persevere, graduate, and pursue graduate school or enter the engineering workforce.[11][12]

Mentoring: Students' Perspective

We asked student participants to evaluate the mentoring process and their mentors. Overall, students reported an excellent opinion about their mentors. Table 3 presents students' responses for years 1 and 2, evaluating "very well" or "well"—similarly, Table 4 summarizes students' satisfaction with their mentoring experiences in years 1 and 2. The top areas with a positive satisfaction level were:

- Communicated his/her ideas effectively (at a level that you were able to understand) – 88%
- Established a positive relationship with you – 87%
- Provided helpful feedback and constructive criticism – 85%
- Was easy to approach and talk to – 83%
- Encouraged you to apply for summer research programs – 77%

Table 3. Students' Level of Satisfaction of the Mentoring Process in Years 1 and 2.

Assessment Area	Year 1 n = 66		Year 2 n = 80		Average Score
Communicated his/her ideas effectively (at a level that you could understand).	58	88%	70	88%	88%
Established a positive relationship with you.	56	85%	71	89%	87%
Provided helpful feedback and constructive criticism.	56	85%	68	85%	85%
Was easy to approach and talk to.	55	83%	66	83%	83%
Encouraged you to apply for summer research programs.	50	76%	63	79%	77%
Provided timely feedback.	54	82%	58	73%	77%
Kept scheduled meetings.	48	73%	53	66%	69%
Encouraged you to apply to a COOP Program.	43	65%	56	70%	68%
Encouraged your initiative to explore new research topics and methodologies.	46	70%	52	65%	67%
Encouraged you to be critical and objective in your research results and ideas.	41	62%	47	59%	60%
Helped you with setting research goals.	40	61%	48	60%	60%
Offered thoughtful advice on your research progress and results.	40	61%	47	59%	60%
Encouraged you to feel excited or motivated about your research.	44	67%	40	50%	58%
Encouraged you to participate in conferences and scientific meetings.	40	61%	42	53%	57%

Also, students reported being very satisfied or satisfied with the following aspects of their mentoring experiences:

- The way their mentor treated them – 87%
- His/her communication approach toward you – 83%
- The performance standards established by mentors – 79%
- His/her style of mentoring – 78%
- The relationship established – 76%

Table 4. Students' Level of Satisfaction of their Mentoring Experiences in Years 1 and 2.

Assessment Area	Year 1 n = 64		Year 2 n = 79		Average Score
The way your mentor treated you	56	88%	68	86%	87%
His/her communication approach toward you	54	84%	64	81%	83%
The performance standards established	51	80%	62	78%	79%
His/her style of mentoring	49	77%	62	78%	78%
The relationship established	50	78%	59	75%	76%
The structure or organization of the meetings	48	75%	57	72%	74%
The written plan included goals to be met under his/her guidance	45	70%	55	70%	70%
The way your mentor treated you	56	88%	68	86%	87%
His/her communication approach toward you	54	84%	64	81%	83%

We also explored students' perspectives on other non-academic mentoring processes. On average, 84% of the students felt their mentors cared about their academic and professional development. Also, 65% of the students felt that their mentor was concerned about their emotional well-being. Finally, 72% expressed feeling supported by their mentors.

According to students, during the first year, the primary strength of their mentor was:

- Effective communications skills.
- Providing helpful advice.
- Motivation/disposition.
- Knowledge and experiences.
- Supportive and caring.

Similarly, the major weaknesses of their mentors include:

- Accessibility (lack of time to talk, have meetings, never developed a work plan or arranged meetings with me, involved in many different things simultaneously, too busy).
- Mentor personal attributes such as intimidating or shyness.

- Counseling (no suggestion on applying for out-of-campus career experiences, like research or internships).
- Lack of objectivity.
- Lack of follow-up (no approach and directions as to the plan).

In contrast, fifteen students did not identify any weaknesses in their mentor. Students' second-year responses indicated that the primary strength of their mentor was:

- Supportive and caring in both academic and personal areas.
- Knowledge and experiences.
- Effective communications skills.
- Constructive criticisms (commitment/devotion).
- Provided helpful advice.

On the contrary, the main weakness identified by students was:

- Low accessibility due to lack of time to meet and talk.
- Being a very busy person since he/she had a lot of mentees and classes.
- Limited hours for meetings.
- Inadequate time management.

Significantly few students reported a lack of organization, communication skills, and empathy. Overall, twenty-six students did not indicate any weaknesses.

Mentoring: Mentors' Perspective

Overall, mentors described their tasks and responsibilities in the program as follows (1) serve as a student mentor, (2) offer academic counseling to students in the program, (3) encourage students to apply to summer research programs, and (4) help students to set career goals. Other duties mentioned were to:

- Connect students to internships and COOP.
- Encourage students to prepare and submit resumes.
- Assist students with their summer research program application.
- Advise students about scholarships and other financial aid.
- Offer recommendations to students regarding their research.
- Offer students an opportunity and encouragement to engage in networking.
- Assist students with their COOP applications.
- Help with an oral/poster presentation.
- Review papers for publication.
- Assist with applications for graduate school.

When asked about the program's impact on their academic and research careers, mentors agreed that their duties with the program required more time than expected. Overall, mentors viewed their involvement in the program to have a weak or low impact in the following areas:

- Increased the number of students in their programs.
- Increased the opportunity to carry out research.
- Helped to obtain release time.

- Increased their participation in professional/scientific meetings or conferences.
- Increased their publications in professional/scientific journals.
- Received economic compensation.

In contrast, mentors had a more favorable opinion about how they benefited from their participation in the program in the following areas:

- Helped them to become a role model for students.
- Made them more aware of students' knowledge and skills deficiencies.
- Helped students gain academic and professional skills.
- Improved their relationship with students.
- Improved their skills as a mentor.

Furthermore, mentors expressed "strongly agree" or "agree" that the workshops offered to them regarding the mentoring process were helpful. All the mentors developed a sense of belonging and felt comfortable being part of the PEARLS team. They answered mostly being "strongly in agreement" or in "agreement" with these statements:

- The PI of the Program recognizes my contributions as a mentor.
- The PEARLS Executive Committee members recognize my contributions as a mentor.
- The Executive Committee members are open to criticism and recommendations.
- The team considers my ideas or opinions.

Conclusions and Implications

The activities proposed in the L-CAS Model has the intention to determine what makes students succeed by combining elements of Lent Social Cognitive Career Theory (SCCT) [5] and Tinto's Departure Model [6]. In terms of their mentoring process, participant students reported an overall excellent opinion about their mentors and the mentoring process provided through the program. They expressed to be very satisfied with their relationship with their mentor regarding communication, connection, professionalism, and encouragement. Few students indicated weaknesses in their mentor, including poor accessibility due to lack of time, feeling intimidated by the mentor, and inadequate counseling. From the mentors' perspective, their tasks and responsibilities align with what students expect from them. We noticed a relationship between what mentors perceived as their duties and what mentees identified as strengths of the mentoring program. For instance, their commitment to serve as a student mentor by offering academic counseling, encouragement, recommendations for COOP and research experiences, and setting career goals has resulted positive to establish a good relationship with the mentee.

Finally, we concluded that both students and mentors felt satisfied with their involvement in the program. Similarly, mentors agreed that the time and commitment required to fulfill the responsibilities in the program are limited due to other obligations, such as teaching, research, and service commitments. This situation reflects on the mentees who expressed concern about the time availability of their mentors due to other professional obligations. Regardless, we conclude that the goal of the mentoring program proposed to promote a sense of belonging in mentees during their years of study was accomplished.

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