ASPIRE: Achieving STEM Persistence through Peer-Assisted Learning and Leadership Development

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PROBLEM STATEMENT

Achievement gaps and attrition of underrepresented minorities (URM) and women in STEM majors have been linked to institutional barriers such as insufficient peer networks and negative faculty attitudes. The proposed **Achieving STEM Persistence through Interventions Related to Empowerment (ASPIRE)** project will engage students at Sacramento State in experiences that address these barriers through: 1) the adaption and implementation of the Peer Assisted Learning (PAL) program in gateway engineering courses; and 2) the implementation of the STEM Leadership Academy for students from the Colleges of Engineering & Computer Science (ECS) and Natural Sciences and Mathematics (NSM). This project builds on the success of the NSM PAL program (NSF 1068383) by adapting PAL into engineering courses (ECS PAL) to introduce cooperative learning experiences and student-led action-research projects to increase academic performance and narrow achievement gaps for URM as students transition from lower to upper-division coursework. The STEM Leadership Academy is grounded in the theoretical framework of the Social Change Model for Leadership Development that situates leadership as a "values-based process that results in positive social change." It develops leadership efficacy and capacity, outcomes that predict educational persistence and will aid in student transitions from upper-division coursework to entry-level STEM careers. Both ASPIRE activities develop problem-solving skills, enhance team-based skills, and build a community among students who may not otherwise engage on campus. To ensure the success of these interventions, faculty attitudes related to student capabilities will be addressed through professional development workshops. Long-term expected outcomes for ASPIRE include increased retention and graduation rates for STEM students, particularly women and URM by promoting student success through two critical transitions: 1) from lower division to upper division coursework in engineering; and 2) from upper division coursework to an entry-level STEM career. A mixed methods study will: 1) evaluate the impact of ASPIRE activities on students' knowledge, skills, and attitudes, specifically women, URM, and transfer students, 2) explore how aspects of ECS PAL and STEM Leadership Academy contribute to successful student transitions, degree attainment, and workforce readiness, and 3) explore the impact of ASPIRE on faculty expectations regarding student ability to serve in leadership roles.

BACKGROUND

With native STEM students experiencing extremely low graduation (4-year: 13%) and retention rates (lower to upper division: 66-68%) and transfer STEM students experiencing similarly low graduation (2-year: 18-24%), but not ideal retention rates (lower to upper division: 88%), an intervention is needed at Sacramento State.

Recent research shows that interventions which address social-psychological needs *in addition* to their academic needs improves performance and persistence of STEM majors. Both ASPIRE interventions will foster academic communities and support networks to meet these needs.

A sense of belonging is difficult to foster for varying reasons: 1) the university boasts an ethnically diverse student body with over 73% non-white students (37% URM); 2) roughly 94% of STEM students live off campus; 3) 57% transfer into STEM majors with varying amounts of the major completed; 4) over a third are first generation students; and 5) women make up only 16% of the College of ECS. Underpinning this issue, faculty diversity has not kept pace with the rapidly changing student demographics and the majority of STEM instructors are part-time faculty (ECS: 9% URM, 16% women, 59% part-time; NSM: 6% URM, 45% women, 54% part-time). These characteristics are similar at other large, public institutions across the nation where a lack of perceived connection to STEM role models negatively affects student performance and retention.

To transition into a STEM career post-graduation, students must capitalize on their content knowledge and a suite of non-technical interpersonal and cognitive skills that often are not intentionally nurtured in their undergraduate programs. Leadership competency is frequently noted as a vital skill set sought by employers, yet it is rarely included in an undergraduate experience.
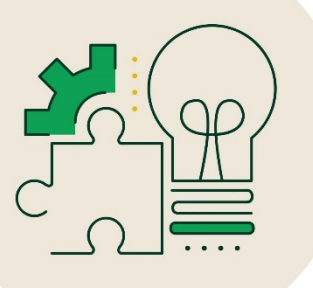
The Multi-Institutional Study of Leadership showed that formal leadership programs, regardless of the duration of contact, have a significant impact on leadership skills. We seek to purposefully develop and hone students' skills with the goal of creating a robust, self-aware group of diverse STEM leaders cognizant of their workforce skills and attributes through:

1) Implementation of the ECS Peer Assisted Learning (PAL) program
2) Development of the STEM Leadership Academy that unites students across NSM & ECS

SUMMARY OF WORK

HORNET LEADERSHIP PROGRAM

SACRAMENTO STATE

SEMINARS
Offered throughout the year, these seminars are open to all STEM students interested in exploring their leadership potential by interacting with established STEM leaders. Seminars will provide opportunities for students to engage with successful leaders as they describe their professional experiences, answer questions, and offer advice for success.
Audience: All STEM students

WORKSHOPS
Offered four times per year, these workshops will focus on hands-on opportunities to explore common leadership themes, develop leadership capacity, and craft leadership skills to enhance academic and career competitiveness. Workshops will be facilitated by Peer Leaders who have developed expertise in this area through their participation in the leadership course, ENGR/NSM 193.
Audience: All STEM students

COURSE
ENGR/NSM 193 is a one-unit course that will focus on in-depth leadership training and professional STEM success. Through their participation in this course, students will explore aspects of effective leadership, uncover their own leadership capacity and skills, and enhance their leadership skills by studying and applying recognized best practices.
Audience: STEM Sophomores +

SCHOLARS
This summer opportunity will provide a culminating, immersive, hands-on leadership experience for students who have previously completed ENGR/NSM 193 or 197. Through this experience, students will have the opportunity to apply and further develop their leadership skills as they propose, vet, and potentially implement a project designed to have a positive impact on the community.
Audience: STEM Juniors +

FOR MORE INFO:
https://www.csus.edu/college/engineering-computer-science/student-success/hornet-leadership-program

ECS Peer-Assisted Learning (PAL) Program

- PALs are optional 1 unit courses where students work on faculty-developed problem sets in groups of 3-4 for 50 minutes twice a week

- When students get stuck, they can ask their PAL facilitator for assistance. Facilitators ask questions to identify what students understand at a basic level, and then guide them (via more questions) to higher and higher levels of competence, until they are able to solve the original problem on their own.

- Facilitators do NOT provide or confirm answers

Hornet Leadership Program

- Grow what's been successful in each college into one program supporting all STEM students.
  - Equitable partnership between the two colleges.

- Develop leadership skills like assertive communication, workplace empathy, self-initiative, and team-management.

- Interest a broad population of students with community-based, socially-relevant, and collaborative experiences

- Meet the needs of industry partners/future employers/graduate programs

Timeline for Peer-Assisted Learning Program
Spring 2021 – PAL courses for ENGR 30 & 112
Enrollment:
ENGR 197 (facilitator training): 8 students
ENGR 30 PAL (ENGR 12A): 17 students
ENGR 112 PAL (ENGR 12B): 28 students
Fall 2021 – Add PAL Course for CSC 15
Fall 2022 – Add PAL Course for ENGR 45
Fall 2023 – Add PAL Course for ENGR 50

Timeline for Hornet Leadership Program
Scholars (First cohort Summer 2021)
Seminars (Fall 2021)
Workshops (Fall 2021)
Emerging Leaders in STEM Course (Fall 2021)
Student Leadership Conference (Spring 2022)
Poster Presentations (PAL & Scholars)
Workshops/Panels run by alumni
Proposals for student org activities

IMPACT ON COMMUNITY

The goals of the project are to:

<u>Short & Intermediate Term:</u>
- **Increase academic performance (course grades, pass rates) to decrease time to graduation**
- **Increase student self-efficacy (as it relates to belief in the ability to continue in/complete a STEM degree/pursue a STEM career), sense of belonging, and intentions to persist in STEM**
- **Increase student leadership opportunities and develop student non-technical communication, self-initiative, and teamwork skills.**
- **Increase faculty expectations regarding student ability to serve in a leadership role.**

<u>Long Term:</u>
- **Increase the number of transfer students, women and URM that persist in lower to upper division courses and engineering majors and narrow achievement gaps.**
- **Increase workforce readiness and entry level job attainment of women and URM in STEM workforce.**
- **Generate new knowledge regarding the extent to which the underlying theories guiding ECS PAL and the STEM Leadership Academy have on student engagement, degree attainment, and workforce**