Preparing Resilient Individuals to Succeed in Engineering: Results from 4 Years of Academic Support and Career Readiness Activities through NSF S-STEM

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Introduction

The PRISE program at Louisiana State University is currently in its fourth year of funding from an NSF S-STEM grant. The overall goal of this program is to help engineering students with unmet financial need, who are both underprepared and have high potential to succeed academically and professionally in engineering and computer science. To ensure best practices were employed to help these students, LSU formed a team of faculty, administrators, and staff from the College of Engineering and the College of Human Sciences and Education to lead this effort.

For this grant work, we operationally defined underprepared students as students lacking the academic qualifications, or academic rigor, expected of engineering students at a research university (e.g., lack of AP STEM and advanced courses, particularly Calculus and Physics) [2]. Our inclusion criteria for participants were high achievement potential (ACT 27-29), high school GPA of 3.5 or higher, underprepared for engineering (lacking AP and advanced STEM coursework), and having unmet financial need. The program consists of a scholarship award tied to a series of professional development workshops and other academic activities designed to 1) improve scholars' academic performance; 2) create a sense of community among scholars; and 3) increase employers' recognition of the capabilities of students from low socioeconomic backgrounds. Five objectives were established to help reach these goals: 1) use direct education and interventions to build these students' foundation; 2) reduce the time to graduation through financial and academic support; 3) improve scholars' professional skills through workshops and experiential learning; 4) increase employer awareness of NACE competencies [1] to evaluate interns; and 5) increase the number of engineers and computer scientists entering the workforce by supporting students who are underprepared, but show promise, for the rigors of these fields.

The theoretical framework for both the grant and this manuscript is Lent, Brown, and Hackett's Social Cognitive Career Theory (SCCT) [3]. This theory helps explain why individuals persist through a given academic program or field of study over time based on personal and contextual factors, personal interests, and the development of career efficacy based on experiential learning. Lent et al. developed this theory based on Bandura's Social Learning Theory which posited that individuals' outcome expectations are heavily influenced by performance accomplishment over time [4]. In this NSF-sponsored program, the PIs sought to promote engineering outcome expectations through career access and experiences, based on high-impact practices research, such as faculty mentorship, conference presentations and networking, and assisting students in participating in multiple internships [5]. Aligned with SCCT, this program and research are meant to provide contextual support to engineering students (e.g., academic and career workshops, peer and faculty mentoring, financial support through scholarships math bridge program), while also promoting performance (GPAs), persistence (program and university retention), and competence (outcome measures). We hypothesize, based on SCCT, that the more high-impact practices (HIPS) the students in the program participate in (attendance at workshops, faculty mentorship, industry mentoring program, internships), the greater their efficacy will be.

Program Description

There are three cohorts of students in the PRISE program, with the first cohort in their fourth year, the second cohort in their third year, and the third cohort in their second year at the university. Participants were selected for each cohort through a rigorous scholarship application and vetting process [6]. Applicants were first screened for financial need (based on their unmet need calculation from their FAFSA) and academic potential (high school GPA, ACT, or ALEKS scores, if provided, and/or high school performance). Then they were reviewed by a committee of faculty and staff who evaluated students on 14 factors including their open-ended responses to essay prompts regarding their interest in engineering, extracurricular activities, and what they hope to get out of the program if selected. Each applicant was independently reviewed and scored by 2-3 committee members, and scores were discussed to make final selections. 15 scholars were selected in Cohorts 1 and 2, and 19 scholars were selected for Cohort 3. Due to this holistic selection process, the scholars are more demographically diverse in comparison to the College of Engineering as a whole (Table 1).

Table 1. Demographics of PRISE Scholars Compared to LSU's College of Engineering population.

	LSU College of Engineering	PRISE Scholars
Gender	24.4% women, 75.5% men	44% women, 56% men
Race or Ethnicity	26% underrecognized	49% underrecognized

During scholars' first year of the program, they attended a series of workshops–four academic-based workshops offered in the fall semester (time management, learning styles, red flags, and resume-building) and six career-focused sessions in the spring semester tied to NACE competencies [1]. Freshmen were also highly encouraged to participate in two bridge programs offered through the College of Engineering and a free tutoring program, all of which featured current engineering students as mentors. Further details regarding the PRISE program and workshop topics were provided in a previous paper by former co-PIs [6]. After freshman year, additional professional development workshops were offered to these scholars on topics such as,

- Internship Advice: PRISE Scholars who've successfully completed internships shared with the other participants how they received/negotiated their offers and navigated their internship experiences;
- How to "Skill-Up" Your Resume: LSU's Olinde Career Center shared tips on how to make their resumes stand out and get through AI screening processes;
- Graduate School 101: college staff led an informative session comparing types of post-graduate degrees that featured a panel of current grad students who shared their personal experiences in selecting a program of study, tips for a successful application, and surprises they encountered in the transition from undergraduate to graduate student; and

- Interviewing Dos and Don'ts: This workshop features lessons on interviewing paired with mock interview practice and feedback from graduate students.

Outcomes

PRISE Scholars have been mostly successful and outperformed expectations. The criteria for a scholar to continue to receive the scholarship are to maintain a GPA of at least 2.7, continue to pursue an engineering or computer science major, and to participate in program activities. Cohort 1 has retained 12 of the original 15 scholars (9 of which are projected to graduate in May 2026, 4 years since starting at LSU), Cohort 2 has retained 12 of 15, and Cohort 3 has retained 15 of 19. Overall, their retention rates in engineering are either on par or higher than other students in the College of Engineering at LSU, and these underprepared students have earned and maintained higher GPAs than their peers (Tables 2-4).

Table 2. Year 4 Summary of PRISE Scholars

PRISE Scholars (current number in cohort)	# initially selected	# changed major (outside of engineering)	# opted not to participate in program	# low GPA/left the university
Cohort 1 (n=12)	15	1	0	2
Cohort 2 (n=11)	15	1	1	1
Cohort 3 (n=15)	19	1	0	3

Table 3. Retention Rates of PRISE Scholars Compared to All Students in the LSU's College of Engineering.

Cohort (year entered university)	LSU College of Engineering Overall Retention	PRISE Scholars' Retention in Engineering
2022 (Cohort 1)	62.9%	80%
2023 (Cohort 2)	75.4%	80%
2024 (Cohort 3)	[data not available]	78.9%

Table 4. Comparison of average GPA between PRISE Scholars and LSU's College of Engineering Overall (Spring 2025).

LSU College of Engineering	PRISE Scholars
3.065	3.563

Pre- and post-surveys were developed and administered for each workshop to measure students' knowledge gains. Each survey consisted of a series of 5-10 multiple-choice questions on the workshop topic with the post-survey including several additional questions for them to rank their enjoyment of the workshop. Dependent samples t-tests were performed to compare the group's mean knowledge of the topic before and after the workshops. Last year's survey results indicated that overall, participants had positive, knowledge gains and enjoyed attending the workshops. Statistically significant improvement in students' knowledge was observed in four workshops, particularly the topics related to the NACE competencies which focus on employability competencies (Table 5).

Table 5. Summary of Workshop Survey Results: 2024-2025 Academic Year

Workshop Topic	# of students	Overall Enjoyment Rating (5.0 scale)	Average # questions correct on pre- and post-survey	Knowledge Gains from Pre- to Post-Survey
Time Management	16	4.64	Pre=3.29/5 Post=3.38/5	Not significant (p<0.28)
Learning Styles	12	4.57	[data not available]	Not significant (p<0.153)
Resume Workshop	13	4.62	Pre=5.64/10 Post=7.77/10	Significant (p<0.0008)
Teamwork and Communication	16	4.60	Pre=3.50/10 Post=4.63/10	Significant (p<0.0169)
Career Development and Professionalism	14	4.70	Pre=3.00/6 Post=4.71/6	Significant (p<0.0009)
Leadership	13	4.74	Pre=1.85/5 Post=2.31/5	Significant (p<0.0266)
Ethics in Engineering	12	4.64	Pre=3.59/5 Post=3.62/5	Not significant (p<0.3772)
Critical Thinking & Technology	9	4.80	Pre=2.44/5 Post=2.67/5	Not significant (p<0.3227)

All students in the program complete a composite Efficacy Survey which includes the *Career Outcome Expectancy Scale* [7], *Engineering Motivation Survey* [8], *General Engineering Self-Efficacy* [9], and the *Self-Efficacy for Academic Learning Scale* [10]. To date, preliminary data reveals that students experience lower motivation and efficacy in their second year of the program and that students participating in internships experience higher efficacy and motivation than those who do not as we hypothesized based on our SCCT framework [3].

Students also completed an involvement survey in May 2025 and participated in one-on-one interviews regarding their internship experiences in Fall 2025. Results of these surveys showed that 80% of these scholars have been active in high-impact practice participation [5] including student organizations (33% of which have leadership roles), nearly half have held STEM-related campus jobs (45%), over a quarter of them have participated in research, and 32% have volunteered for service-related projects in the community. Over half of PRISE participants have received at least one internship as of summer 2025 at companies such as ExxonMobil, NASA, NBC Universal, Tesla, and the Governor's Office of Homeland Security and Emergency

Preparedness. An in-depth, qualitative analysis of scholars' internship experiences will be presented in ASEE's Cooperative and Experiential Education Division [11].

Limitations

The PRISE program has served 49 students total to date. Preliminary data demonstrates program efficacy for implementation of HIPs and career development. However, caution is warranted when reviewing these findings. Students selected for the program were highly motivated as evidenced by their high school GPAs and ACTs despite under-preparation for engineering. Participants were given many additional resources (workshops, tutoring, supplemental instruction, access to bridge programs, etc.) and access to nationally recognized experts in engineering and career development. Special attention was given throughout the program to first signs of academic struggle and early intervention. These specifics could make program replication at larger scale difficult to implement and not generalizable to all engineering students [12]. Analysis is further limited by the low sample size, excluding more sophisticated multivariate analyses.

Conclusions and Future Plans

The results of the PRISE Program on participant academic performance, engineering retention, and internship success illustrate that underprepared students can succeed, and surpass, their peers if given the proper support. These students not only received financial support through this scholarship, but also forged valuable connections with faculty, staff, professionals, and their peers while gaining skills to be better prepared to enter the global workforce.

Next steps include gathering feedback from internship employers regarding PRISE Scholars' NACE competencies, facilitating an industry mentoring component for students who have yet to participate in an internship, and continuing to provide support and assistance to participants through additional informative workshops and professional development opportunities.

Future research includes analyzing which HIPS created the greatest increase in engineering efficacy based on SCCT [3]. We also plan to analyze data on the participation in HIPS and college GPA. Finally, we are researching job placements, salary, and industry for each of our scholars as they graduate.

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