WIP: How the STEPS Program Enhances the First-Year Experience for Engineering Students

Cory Budischak, Temple University

Dr. Cory Budischak, Associate Professor of Instruction at Temple University, focuses on transitioning to 100% renewable energy and advocacy for policy implementation at state and national levels. He's part of Delaware's GEAC, aiming to halve emissions by 2030 and eliminate them by 2050. Budischak champions a holistic view of energy systems in order to most effectively transition to a low carbon economy. A proponent of innovative teaching methods like flipped classroom problem based learning and design thinking, he also co-founded the STEPS program (funded through NSF S-STEM) to support low-income, high-achieving engineering students. Budischak holds a Doctorate in Electrical Engineering and enjoys outdoor activities with his family.

Dr. Shawn Fagan, Temple University

Dr. Shawn Fagan is the Assistant Dean for Undergraduate Studies in the College of Engineering at Temple University. He received his Doctor of Education in Higher Education Administration from Temple University.

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Introduction

The Sustainable Temple Energy and Power Scholars (STEPS) program is a $1.5 million S-STEM initiative that offers scholarships, along with curricular and co-curricular support, to low-income, high-achieving students at Temple University. The program is designed for students majoring in Electrical and Computer Engineering. The objectives of the project are to increase enrollment of low-income, academically talented students, to increase the retention and graduation rates of these students, and to support career pathways into engineering and specifically the sustainable energy and power sector.

The project is guided by Social Cognitive Career Theory [1] and the project activities are structured to positively influence the scholars' self-efficacy and outcome expectations in engineering while also fostering a sense of belonging within the engineering program. This framework can be seen in Figure 1 and Table 1 shows the timeline of project activities and the relationship of the activities to the SCCT framework.

Figure 1: SCCT Framework, adapted from Lent et. al. [1] Numbers 1-5 in the figure are linked to the factors listed in
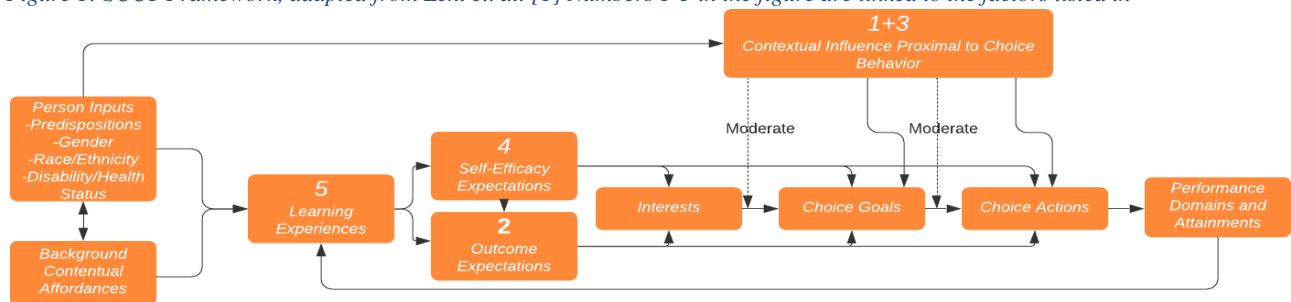

Table 1: Summary of STEPS project activities, timeline*, and relationship to influential factors. NOTE: To see how these factors are linked to SCCT, see Figure 1.

1. Sense of Belonging [2]
2. Outcome Expectations [3]
3. Supports
   a. Faculty Mentoring [4]
   b. Peer Mentoring [5], [6]
   c. Peer Support/Study Groups [7]
   d. Engineering Barrier-Coping Strategies [8], [9]
4. Self-Efficacy [10], [11]
5. Student Experiences [12], [13]

*Related activities are grouped by color in the timeline, and are Cohort Building (Orange), Multi-Level Mentoring (Blue), Curricular Activities (Green), and Industry Involvement (Yellow)

Project Approach

The STEPS program will conduct a long-term, in-depth study to understand the experiences of low-income, high-achieving STEPS scholars. The goal is to identify the factors that influence their academic and career choices and their persistence in these fields. Figure 1 shows where these factors impact the SCCT framework, and Table 1lists these factors. The study will employ a qualitative methodology called Interpretative Phenomenological Analysis (IPA), which allows for a detailed exploration of the participants' experiences. This method involves organizing and preparing the data, reducing it to key themes, and interpreting it through discussions and visual representations which is a similar analytical approach commonly found in qualitative research [14]. The data analysis will follow a structured process: managing and organizing the data, reading, and noting emerging ideas, describing and classifying themes, developing interpretations, and visualizing the data. In addition to IPA, the research methods will include certain aspects of reflective lifeworld research [15]. The research will address the following questions:

1. How do academic and career choices and persistence develop for low-income, high- achieving students in the STEPS program?
2. What impact do learning experiences and support programs have on these students' choices?
3. How do these students overcome social and cultural barriers to persist in the STEPS program?
This research also aims to answer the engineering community's call for more qualitative studies on student persistence in engineering.

The STEPS program welcomed its first nine scholars in the Fall of 2023. Project activities for the first year are listed in Freshman columns of Table 1. Below, several of the activities are described in more detail.

Introduction to Engineering Course and First-Year Seminar Courses: Before the semester started all nine STEPS scholars were enrolled in the same Introduction to Engineering and First-Year Seminar course. This Intro course was taught by the faculty member who would also be their faculty mentor throughout the STEPS program and the Seminar course was taught by the STEPS researcher who would also serve as their academic advisor. The Intro course had many other students in it, but the seminar course was limited to the nine STEPS scholars. By intentionally scheduling the students in this manner, a cohesive cohort was organically formed, enhancing the scholars' sense of belonging and providing them with easy access to student support services.

Peer Mentoring and Social Events: Before the Fall semester, the plan was for peer mentors to schedule one-on-one meetings with each scholar. However, a much more effective method of peer mentoring was implemented. This is due to the schedules of the scholars in that they all had a free hour or two one day a week between their classes. The peer mentor invited all the scholars to come to a lounge area and eat lunch while the peer mentor would have small discussions with each scholar. In this way, the scholars not only got to meet and discuss with the peer mentor what was going on but also got to chat with other scholars and form more of a community.

Results

The aim of the STEPS program is to study the experiences of low-income, high-achieving scholars through an in-depth and long-term approach using Interpretative Phenomenological Analysis (IPA). The initial cohort of nine scholars began in Fall 2023, with various structured activities designed to foster a sense of belonging, support, and academic success. Of the nine scholars in the program, six achieved a cumulative grade point average (cGPA) above a B- (2.67) by the end of the year. Furthermore, eight out of the nine scholars were retained for the second year, resulting in a first-year retention rate of 89%. This retention rate is notably higher than the College's overall first-year retention rate of 76%. Other key findings are:

1. **Sense of Belonging**: The cohort model, with shared courses and scheduled social interactions, significantly enhanced the scholars' sense of belonging. The Introduction to Engineering and Freshman Seminar courses, both taught by key mentors, helped integrate the scholars into the academic community throughout the first semester.

2. **Support Systems**: Faculty and peer mentoring were crucial components. The faculty mentor's dual role as an instructor and mentor in the Introduction to Engineering course provided continuity and a strong support system. Peer mentoring sessions, adapted to fit scholars' schedules, facilitated community building and provided informal support.

3. **Cohort Building Activities**: The strategically planned cohort activities, such as shared lunches with the peer mentor and tutoring sessions, allowed for organic community building. This not only enhanced the scholars' sense of belonging but also provided a platform for organic peer and academic support.

4. **Academic and Career Persistence**: The initial results suggest that the combination of sense of belonging, support systems, and cohort activities positively influenced the scholars' self-efficacy and academic persistence. The structured support and community feel helped scholars navigate their first year, a critical period for persistence in undergraduate STEM programs.

Finally, the scholars were surveyed of what they found most valuable about their experiences in the program, below are excerpts of their responses:

- *Learning how to better manage my time and give structure to my studying habits to better prepare me for college-level workload and material. (S-1)*
- *Learning about the opportunities at Temple [University] that I can take advantage of. (S-2)*
- *Making connections with peers in the program; exploring more at Temple [University]. (S-3)*
- *Receiving mentorship from the professors. (S-4)*
- *The STEPS seminar helped me adapt to the new college lifestyle. (S-5)*
- *I feel that I am getting enough support to be successful at Temple [University]. (S-6)*
- *I found the STEM tutoring to be helpful. (S-7)*
- *When I have questions regarding the courses I am taking or other academic issues, I feel confident the STEPS team can assist me. (S-8)*

Discussion

The early implementation of the STEPS program demonstrates the potential benefits of a holistic and supportive approach for low-income, high-achieving students. The IPA method provided rich, qualitative insights into the students' experiences, revealing several key factors that influence their academic and career choices and persistence. We look forward to making further improvements to the program in the upcoming year. This includes addressing the scholars' concerns about financial support and offering strategies to help them manage their time and handle the heavy coursework in their second year of the Electrical and Computer Engineering program.

Acknowledgment

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