Development of a Cohort-Based Program to Strengthen Retention and Engagement of Underrepresented Community College Engineering and Computer Science Students

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A Cohort-Based Program to Strengthen Retention of Underrepresented Community College Engineering Students

ABSTRACT

In partnership with the Silicon Valley Engineering Tech Pathways (SVETP), Skyline College developed and began piloting the Engineering & Tech Scholars Program (ETS) program in Fall 2016. The ETS program is a cohort-based learning community designed to address major attrition points and increase the retention and diversity of students pursuing careers in Science, Technology, Engineering, and Mathematics (STEM). This paper details the development, implementation, and initial outcomes of the program in order contribute to the body of research of evidence-based program initiatives to increase the diversity and engagement of underrepresented communities in STEM. Quantitative data and qualitative focus group data that measure student success and engagement are reviewed along with student perceptions of the program to extract key insights to inform future programs and best practices for maximum impact.

1. INTRODUCTION

Despite the growth of minority communities in America during the past few decades, trends in the underrepresentation of minorities in science and engineering have persisted. In 2015, although the total U.S. population was comprised of 13% of African Americans, they represented 5% of the science and engineering workforce. Similarly, although the percentage of Latinos in the workforce increased significantly from 3% in 1970 to 15% in 2011, they represented 6% of workers in science and engineering[1]. Native American, Pacific Islander, Hawaiian, and Southeast Asians also remain underrepresented, making up 2% of the workers. Toward addressing this achievement gap, there is a growing awareness of the role that community colleges play as a crucial gateway for low-income and minority students to pursue careers in STEM. However, this gateway does not always lead to success. A recent study shows that 69% of STEM students pursuing an Associate's Degree on the national level, changed majors or left college without completing a degree or certificate[2]. The educational effectiveness research offices of numerous community colleges largely identify that the Calculus I course serves as a major barrier for an exceedingly high number of students (60-80%) who enter at remedial math levels[3]. Additionally, the difficulty of persevering in STEM pathways is exemplified in the low pass rates (40-55%) for additional core major requirements, such as General Chemistry and Introduction to Programming. The lack of retention of STEM students in community colleges and the lack of growth of minority representation in the science and engineering workforce[4] demonstrates the need to develop strategic programs and practices that increase the number and diversity of students succeeding in STEM.

Skyline College, located in the San Francisco Bay Area, CA is a member of the California Community College System and is a federally-designated Hispanic-Serving Institution. During the 2014-15 academic year, the college enrolled 20,787 unique students, with white students as the largest single group at 20.6%, followed by Asian students at 20.3%, and Hispanic students at 18.1%. Like all California Community Colleges, Skyline College is an open-enrollment

institution, designed to welcome students of all backgrounds. At Skyline College, degrees in Biotechnology, Computer Science, Engineering, Mathematics, Natural Science, and Physics are not awarded in high numbers. In 2014-2015, there were 4 degrees awarded in Biotechnology, 16 in Mathematics, 17 in Natural Science, and 4 in Physics. Only 4% of Skyline College students who transfer to a four-year institution achieve that goal in two years; 27% do so in four years, 37% in five years, and 45% in six years. At each interval, transfer rates are substantially lower for Latino, African-American, Filipino, and Pacific Islander students.

2. Program Components

Over the past several years, Skyline College has made large strides toward reaching an institutional goal of a robust and accessible transfer pathway to 4-year and graduate degrees in Engineering. As a leading partner in the Silicon Valley Engineering Tech Pathways (SVETP) initiative, the college is contributing to an integrated and accelerated system of K-14 STEM career pathways to increase the number and diversity of students succeeding in high-demand post-secondary education and careers in computer science, engineering, and other STEM disciplines. Through this initiative, the Engineering and Computer Science Department developed the Engineering and Technology Scholars (ETS) Program which included the development of new courses and degree programs in engineering and computer science that fully support five pathways including: civil engineering, computer engineering, electrical engineering, mechanical engineering, and computer science. The major components of the ETS Program are designed to address several barriers that hinder the success and retention of students.

2.1 Addressing Barriers to Student Success

The educational effectiveness research offices of numerous community colleges largely identify that the Calculus I course serves as a major barrier for an exceedingly high number of students (60-80%) who enter at remedial math levels. Statewide, only 4% of community college students starting at Intermediate Algebra pass through to enroll in Calculus I within 6 consecutive semesters. This is a significant barrier since students who do not pass Calculus I cannot move forward to enroll in advanced Physics and Engineering courses.

Analyses conducted by Skyline College's Office of Planning, Research, & Institutional Effectiveness have found that the most common "attrition points" for students on a STEM-related pathway at Skyline College are the failure to pass MATH 251 (Calculus 1; 60% success rate); PHYS 250 (first-course in the 3-course Calculus-based Physics sequence; 60% success rate); and CHEM 192 (prerequisite to the CHEM I and II sequence, 55% success rate). Students who do not pass Calculus 1 are unable to advance for further study in "Calculus-based" STEM disciplines: Engineering, Math, Physics, Chemistry, Biology, Geology, or some Environmental Sciences. If we consider attrition from subsequent courses in these sequences, only about 33% of students who enter the CHEM I and II sequence complete it, and only 40 of every 100 do so in the Physics sequence.

These attrition points reflect the reality that the vast majority of Skyline College students, including many interested in pursuing STEM-related careers, are not ready for college-level math when they get to the college. On the math placement test administered to students enrolling

for the first time in Fall 2014, only 16% of students placed in Transfer-Level Math (Trigonometry). Far fewer Latinos (5.4%), African Americans (7.1%), or Pacific Islanders (11.1%) did so. In fact, 60% of the students placed into at least two levels below Transfer-Level; this was the case for 75% of Latinos and 82% of African Americans, compared to 38% of Asians and 60% of whites. A student placing two levels below Transfer-Level Math must in fact pass five levels of Math (Elementary Algebra, Intermediate Algebra, Trigonometry, and Pre-Calculus) before getting to the first of three Calculus courses required for degree attainment in most STEM disciplines. The further "down" in the math sequence a student begins, the greater the odds against persisting and succeeding in a STEM major.

Table 1. Pass Rates of Prerequisites Courses at Skyline College

Courses	**College Average Pass Rate**
Trigonometry	43%
Pre-Calculus	58%
Calculus I	55%
Physics	54%
General Chemistry	58%
Introduction to Programming (C++)	49%

Additionally, the difficulty of persevering in STEM pathways is exemplified in the low pass and high attrition rates for additional core major requirements. Table 1 shows the average pass rates for the following core courses: General Chemistry, General Physics, and Introduction to Programming. Engineering and Computer Science majors, in particular, require extensive prerequisites which then causes the experience of pursuing these degrees to be front-loaded with challenging Math, Chemistry, and Physics courses. Without early access to Engineering and Computer Science classes that first enticed students to the major, this exacerbates the challenges with retention and engagement.

2.2 Cohort System

Students in the ETS program enter a cohort system that encourages the development of a strong community of peer and faculty support. Together, the cohort moves through accelerated math courses and core courses, allowing for accelerated transfer in comparison to traditional pathways. The Accelerated Math and Engineering curriculum are co-designed by Skyline Math and Engineering faculty to context learning to science and engineering careers. The cohort system is designed to integrate students into a community of academic and social support early on in their journey toward transfer.

In six total semesters, ETS students select a specialized pathway in Engineering or Computer Science, and progress together toward completing an Associates in Science (AS) or Associates in Science for Transfer (AS-T) degree. Internships and other work-based learning opportunities are available for ETS students during the summers and in a final semester prior to transfer to a 4-year degree program. Scholarships and paid summer internships are crucial to offset high financial costs of STEM degrees and give students the flexibility to allocate more time to invest in their education.

In addition, the cohort benefits from a Retention Specialist that is embedded inside the classroom supports in other study session and social settings. The Retention Specialist ensures that students receive wraparound support in the form of case management, coaching, facilitating study skill and transfer preparation workshops, initiating monthly social activities, and connecting students to scholarships and paid summer internship opportunities.

2.3 Accelerated Math Pipeline

With the traditional system, students entering at Elementary Algebra will take at least four consecutive semesters of math before enrolling into Calculus I. ETS has created an accelerated math pipeline from entry-level math to advanced math courses that makes the pathway to STEM more accessible and feasible by giving students the opportunity to accelerate the process while having wraparound support provided by the program. In preparation prior to enrolling into the program, students have the option of taking Accelerated Elementary Algebra and Intermediate Algebra. In the first Fall semester of the program, students enroll in Accelerated Trigonometry and Pre-Calculus as a cohort, and move forward to Calculus I in the Spring.

2.4 Course Sequence

The ETS program has specialized pathways for students in five different major tracks: Civil Engineering, Computer Engineering, Electrical Engineering, Mechanical Engineering, and Computer Science. Figure 1 below shows an outline of the 3-year program. All students in the cohort take a core set of courses together (shown top in green). This track consists of core Math, Physics, and Chemistry courses, in addition to transfer requirements such as English. In the first year, in addition to the accelerated math sequence, students also take fundamental courses that prepare them for success in future advanced coursework, such as Introduction to Engineering, Art of Coding (iOS App Development with Swift Course), and Engineering Graphics.

Engineering & Tech Scholars: Course Sequence

	Year 1				Year 2				Year 3			
	Fall	*Units*	**Spring**	*Units*	**Fall**	*Units*	**Spring**	*Units*	**Fall**	*Units*	**Spring**	*Units*
Core Courses: Core Math, Physics, Chem, English	Trig	*4*	Calc 1	*5*	Calc 2	*5*	Calc 3	*5*	Diff eqn	*3*	Linear Algebra	*3*
	Pre-calc	*5*	English 1	*3*	PHYS 1	*4*	PHYS 2	*4*	PHYS 3	*4*	Gen Chem 1	*5*
Core Units		9		8		9		9		7		8
Civil Engineering Track	Intro to ENGR	*3*	ENGR Graphics	*4*	MATLAB	*4*	Statics	*4*	Dynamics	*3*	Materials Science	*4*
									Circuits	*3*		
Total Semester Units		**12**		**12**		**13**		**13**		**13**		**12**
Mechanical Engineering Track	Intro to ENGR	*3*	ENGR Graphics	*4*	MATLAB	*4*	Statics	*3*	Circuits	*3*	Materials Science	*4*
					Gen Ed	*3*	Gen Ed.	*3*	Circuits Lab	*1*		
Total Semester Units		**12**		**12**		**16**		**15**		**11**		**12**
Electrical Engineering Track	Intro to ENGR	*3*	Intro to Coding	*3*	C++ 1: OOP	*3*	Micro-controllers	*1*	Circuits	*3*	Computer Architecture	*3*
					Gen Ed	*3*	Gen Ed.	*3*	Circuits Lab	*1*		
Total Semester Units		**12**		**11**		**15**		**13**		**11**		**11**
Computer Engineering Track	Intro to ENGR	*3*	Intro to Coding	*3*	C++ 1: OOP	*3*	Discrete Math	*3*	Circuits	*3*	Computer Architecture	*3*
					Gen Ed	*3*			Circuits Lab	*1*	Gen Ed	*3*
							Micro-controllers	*1*	C++ 2: Data Structures	*3*		
Total Semester Units		**12**		**11**		**15**		**13**		**14**		**14**
Computer Science Track	Intro to ENGR	*3*	Intro to Coding	*3*	Java 1: OOP	*3*	Computer Architecture	*3*	Java 2: Data Structures	*3*	Discrete Math	*3*
			Gen Ed	*3*	Gen Ed	*3*			Gen Ed	*3*	iOS App Dev	*3*
Total Semester Units		**12**		**14**		**15**		**12**		**13**		**14**

Figure 1. 3-Year course sequence for students in the ETS program. Shows core courses all ETS students take together, in addition to major track course for each of the engineering disciplines and computer science.

2.5 Work-Based Learning Opportunities

Students in the program are also connected to Engineering and Computer Science work-based opportunities that are designed to increase overall engagement, technical skills, and exposure to real-world STEM career applications. For example, the Fall 2017 Cohort attended local tech company visits, Women in STEM Conference, TEDx, UC Berkeley Engineering Community College Visit Day, Resume Workshops, and participated in a 2-day AutoCAD and SolidWorks training camp led by Skyline College engineering faculty to build fundamental CAD skills and manufacturing experience. During the course of the year, students are prepared for application and placement into summer internship sites. Selected students are placed into paid summer internships through partnerships with Workforce Development and industry partners such as NASA, Stanford Linear Accelerator Laboratory, Lockheed Martin, Zoox, and more.

3. Results and Evaluation

In order to assess the program impact and student perceptions of the program, a survey was developed to give to new ETS students at the end of their first semester, in addition to students concurrently enrolled in Introduction to Engineering, though not part of the cohort program. The survey was developed by the program's Retention Specialist with input from the lead engineering faculty member in the ETS program. The survey was administered on December 12th, 2017 during the final class meeting for Introduction to Engineering. A total of 50 students took the survey, 25 ETS students and 25 students not in the ETS cohort.

Table 2 summarizes the demographics of the students surveyed in the Fall 2017 semester, both within the cohort group (ETS) and those students who are not part of the program (Non-ETS). The program recruited 28% female students. The largest ethnic group recruited was Asian (72%), followed by Multiracial (12%), Hispanic (8%), and African American and White students (both 4%). The 2017 ETS cohort also holds the following diverse characteristics: 70% of students are first in their immediate family to pursue a career in STEM, 33% are first generation college students, and 15% are Veterans. While the ETS recruitment efforts show a clear increase in female STEM students, as compared to the non-ETS cohort, the ETS team will be working in the future to enhance the ethnic diversity of future cohorts.

Table 2. Demographics of Fall 2017 ETS and Non-ETS Cohorts

Demographics	**ETS**		**Non-ETS**	
	# of Students	**(%)**	**# of Students**	**(%)**
Gender				
Male	18	72.0%	22	88.0%
Female	7	28.0%	3	12.0%
Total	25	100%	25	100%
Ethnicity				
African American	1	4.0%	0	0.0%
Asian	18	72.0%	11	44.0%
Hispanic	2	8.0%	5	20.0%
White	1	4.0%	8	32.0%
Multiracial	3	12.0%	1	4.0%
Total	25	100%	25	100%

One of the goals of the ETS program is to get students started on their Engineering or entry-level Computer Science courses earlier in their academic path. One way to measure this is by assessing how far in the math pipeline students are while enrolled in Introduction to Engineering. Figure 2 shows a distribution of the last math course students had completed from the ETS and Non-ETS cohorts. More than 68% of the students not enrolled in the ETS program had already completed Calculus 1 or a higher math course, while a total of 80% of ETS students had only completed Trigonometry. The data indicate that the recruitment efforts of the ETS program have been effective in getting students enrolled in engaging entry-level Engineering courses earlier on

in their academic path. The data also points to stronger cohesion in experience level within the ETS cohort, whereas general entry students have math experience levels that span a much broader range.

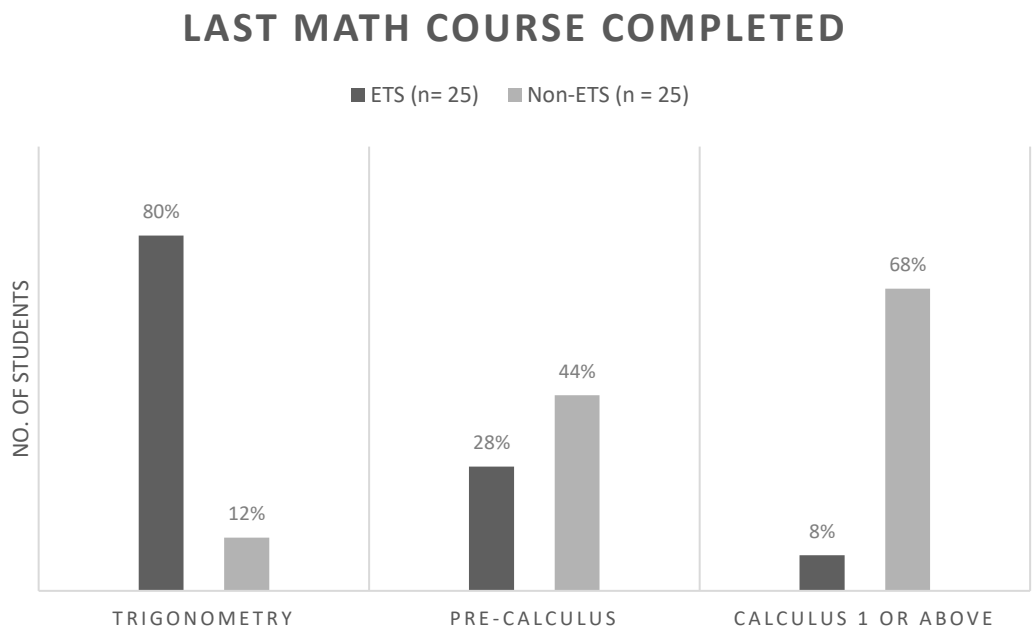

Figure 2. Last math course completed by ETS and Non-ETS students

Table 3 shows the students' own perception on their engagement in the Engineering and Computer Science program at Skyline College. Students in the ETS program report greater engagement than those not enrolled in the program, with 68% of students identifying as highly engaged. This may be due to ETS students having a stronger connection with ETS faculty and their cohort peers through extracurricular networking and team-building events.

Table 3. Attitudes: *"Rate your engagement as a student in the Engineering and Computer Science Department at Skyline College"* Response Scale: 0 – Not Engaged, 5 – Highly Engaged.

Rate your engagement as a student in the Engineering and Computer Science Department at Skyline College	**ETS (n = 25)**	**Non-ETS (n = 25)**
High engagement (responded 4 or 5)	68%	32%
Low engagement (responded 3 or below)	32%	68%

Table 4 shows motivation levels in students in and out of the ETS program. The data indicates that the commitment of students in the ETS program meet or exceed the levels of commitment seen in students not involved in the program, who are further along in their academic pathway as indicated in Figure 2.

Table 4. Attitudes: *"I feel motivated or committed to pursue a degree in Engineering or Computer Science."* Response Scale: 0 – Strongly Disagree, 5 – Strongly Agree.

I feel motivated or committed to pursue a degree in Engineering or Computer Science.	**ETS (n = 25)**	**Non-ETS (n = 25)**
High agreement (responded 4 or 5)	84%	80%
Low agreement (responded 3 or below)	16%	20%

Table 5 shows students' sense of self-efficacy in successfully completing an engineering or computer science degree and moving in a career in their field. The data indicates that students in the ETS program feel more confident than their non-ETS counterparts.

Table 5. Attitudes: *"I feel well-prepared to be successful in my career in Engineering, Computer Science, or STEM."* Response Scale: 0 – Strongly Disagree, 5 – Strongly Agree.

I feel well-prepared to be successful in my career in Engineering, Computer Science, or STEM.	**ETS (n = 25)**	**Non-ETS (n = 25)**
High agreement (responded 4 or 5)	88%	44%
Low agreement (responded 3 or below)	12%	56%

One of the ETS program goals is to connect students to each other through team-building and networking activities. Table 6 shows responses from both cohorts on the sense of community each feels within the Engineering and Computer Science program at Skyline College. ETS students tend to hold a much stronger sense of community than their non-ETS counterparts.

Table 6. Attitudes: *"I feel a sense of community with my classmates within the Engineering & Computer Science Department."* Response Scale: 0 – Strongly Disagree, 5 – Strongly Agree.

I feel a sense of community with my classmates within the Engineering & Computer Science Department.	**ETS (n = 25)**	**Non-ETS (n = 25)**
High agreement (responded 4 or 5)	96%	60%
Low agreement (responded 3 or below)	4%	40%

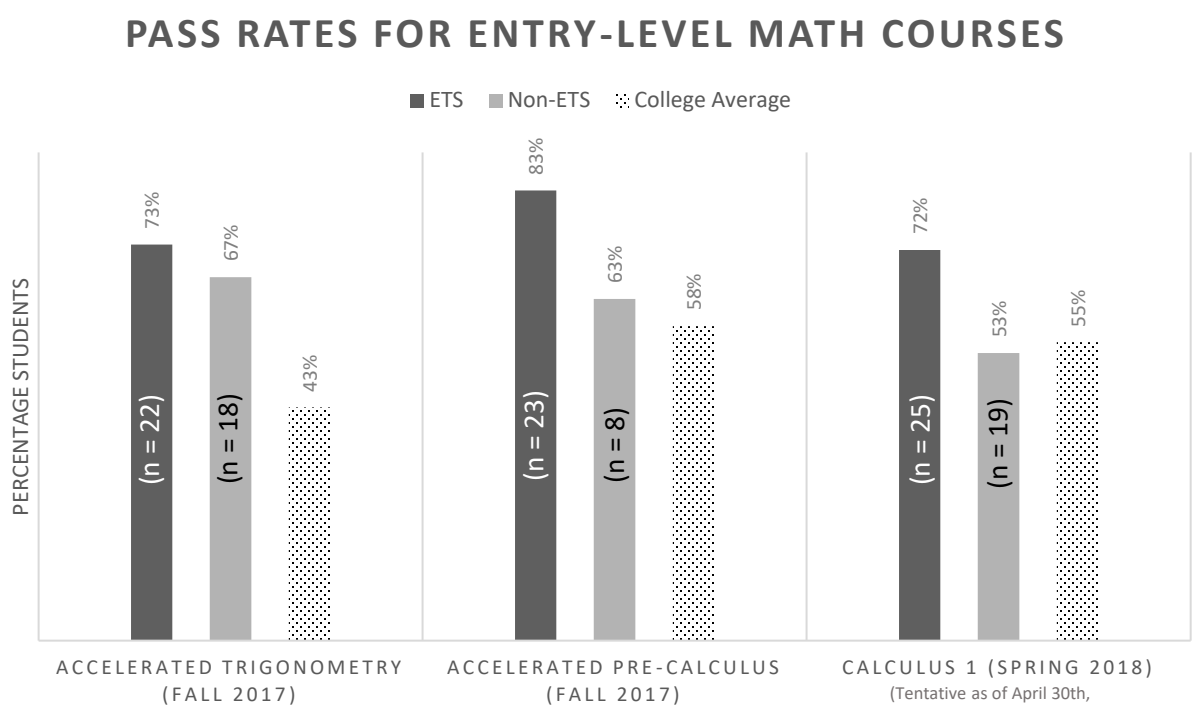

Figure 3. Pass rates for entry-level math courses for ETS, Non-ETS, and students college wide.

In addition to the program survey distributed in Fall 2017, the ETS team has also catalogued and compared success rates in the entry-level math courses that ETS students are enrolled in. Figures 3 shows the pass rates for both ETS and Non-ETS students enrolled in critical math gateway courses to engineering including the accelerated trigonometry and pre-calculus sequence, in addition to the Calculus 1 course. The data indicates that students in the ETS program passed at a higher rate than non-ETS counterparts in each course. Notably, despite taking accelerated courses, ETS students passed at a higher rate than the college average, where students took regular-paced and full-semester length sections. Though not shown in figure 3, the team also measured completion rates in the accelerated sequence in effort to gauge how successful students are in getting through trigonometry and pre-calculus in a shorter time. This measurement showed that 59% of ETS students successfully completed the accelerated sequence, while only 33% of non-ETS students completed the accelerated sequence, indicating that involvement in the ETS cohort program bolsters student success in an accelerated math pipeline.

Focus Group Analysis

To supplement insight from the program survey and to gain a personal perspective of student perceptions of the program, two focus groups were conducted. Six students participated in 75-minute interviews based on willingness and availability to participate. Students were split into smaller groups of three students each to facilitate in-depth discussion. The interview was facilitated by a third-party researcher, and was recorded and thematically analyzed.

Students were asked open-ended questions about their perceptions of the importance or impact of various program components, including math preparation, technical skill workshops, transfer

preparation workshops, social activities, the embedded Retention Specialist, and access to scholarship and internship opportunities. Interviewers also attempted to gauge program impact by assessing factors such as sense of community, sense of identity and self-efficacy as a STEM student, and the preparation for transfer.

After considering the frequency of shared thoughts and feedback, as well as the intensity of student comments, several themes emerged.

Academic and Social Integration. When focus group participants reflected on the cohort-based component of the program, the majority of students expressed the importance of building trust and building a sense of family, and how the bond with their cohort members extended outside of the classroom. A student described the support she receives from her peers, "...After math class, we go straight to my house, and we do group study and we do all the lab reports and kind of help each other out with things that we're weak at. And then on Tuesday and Thursday we take jiu-jitsu classes... It's fun. We kind of just made a bond with each other." Another student noted, "I feel like everyone is literally always talking about math, always talking about engineering. And we're all in it together." From these discussions, it was apparent that students were benefiting both academically and socially from their peer relationships, and that these bonds formed with one another helped them persist in challenging courses.

In addition, several students commented that being alongside peers that were also in the beginning stages of their transfer journey decreased their feelings of isolation and increased their sense of confidence. A student shared, "Seeing that everybody has the same struggles with math, it's a grind. It made me more confident in myself."

Community Increased Help-Seeking Behavior. When students shared about experiencing a sense of community, it was often discussed in context of help-seeking. Several students commented about the fear of asking for help and how the sense of community increased their comfort in seeking help. For example, students particularly expressed the importance of staff-facilitated social activities with their cohort members outside of the academic setting because these events made it more comfortable to seek help from both peers and faculty. When asked about their perceptions of social activities, one student expressed, "I think it's good because it made you more comfortable around everybody. Because if you're not comfortable, you're afraid to ask for help or admit that you're struggling. You might fail a class 'cause you're scared to admit that you need help, and you end up just going home. And that helps in that way."

In addition, several students also expressed the importance of the participation of staff and faculty during a variety of social events the ETS Retention Specialist organized including a ropes course, painting workshop, and karaoke night. From several comments, it became apparent that students perceive a professional boundary with faculty that makes it difficult for them connect to professors and ask for help. A student expressed, "Before ETS, I always thought my professors were scary, like I want to be professional in the same way… But knowing that my professors are humans too and we relate on a certain level… like during the karaoke. It just makes me ease into everything and I feel more relaxed." From these comments, cohort activities served to humanize fellow peers and faculty, which was crucial in creating stronger bonds and enhancing help-seeking.

Importance of an Embedded Retention Specialist. When asked which components of the program were most critical to the program, frequent comments expressed the importance of the role of a Retention Specialist embedded inside the classroom. Students valued the Retention Specialist's presence in the classroom, which seemed to facilitate the connections between peers as well the connections between students and faculty. In addition, the students perceived that being embedded in the classroom allowed the Retention Specialist to observe and personally address individualized areas of improvement. A student shared, "I feel like without [the Retention Specialist], the program wouldn't exist… we wouldn't be connected as well as we would have been, or well-informed about what's going on, or what's to come. And she also helps us study since she is in the class with us." Another student commented, "I do also think it really helps that she's in [the classroom] because she can see how we actually learn. And she'll know how to approach us and how to help us and explain things to me in a way I could understand better because she sees how I learn and knows my personality." Another student shared that the Retention Specialist's presence in the classroom helped him persist in a class he was considering to drop. These accounts demonstrate the embedded component allows students to have access to immediate intervention and individualized academic and socio-emotional support.

Factors Increasing Persistence and Internal Strengths. Notably, a frequently mentioned factor that increased their overall persistence was seeing the dedication of the staff and Engineering and Math faculty that coordinated the program. A student shared, "Seeing people work hard for us makes me want to push farther." Another student shared, "The ETS program enhances the strengths within us and provides me better clarity." From these comments, students felt that being in close proximity of staff and faculty that showed care and dedication, served as a constant reminder for them to work hard and encouraged them to leverage their inherent strengths.

Impact on Transfer Preparation and Self-Efficacy as a STEM student. Several students noted that participation in the program led them to prepare for transfer and apply for internships significantly earlier in their transfer journey. They shared that they valued being exposed to transfer workshops, technical skill workshops, guest speakers, tutors who were further along in their transfer journey, and trips to local universities and tech companies. In addition, they felt like they gained valuable skills through being encouraged to apply to paid summer internships at local companies, and were connected to STEM scholarships they wouldn't have otherwise applied to. A first-generation college student shared that being the first person in her family to pursue college "was very hard mentally" but the program "made it easier and gave me a new level of confidence in pursuing engineering." These various transfer and work-based opportunities collectively enhanced their sense of preparedness for transfer and self-efficacy as a STEM student.

4. CONCLUSION

Pilot implementation of the ETS program has shown to serve as a cost-effective model of a guided pathway that increases retention, provides additional enrichment to students, increases accessibility of scholarships and internships, and bolsters student success in an accelerated math pipeline.

The ETS program shows gains in enhancing students' identity as engineers as indicated by the post-program survey and focus group results. In addition to strong successes in the accelerated math curriculum, the lab activities and design projects in Introduction to Engineering were well received by students and allowed them to explore the major fields of engineering, increase their knowledge of specific engineering topics and disciplines, as well as understand a variety of job functions in an engineering career. The program has also shown to provide context to fundamental physics and math concepts—a strategy that has been proven to increase student motivation and persistence, especially during the potential struggle through the first two years of their engineering studies.

Several key findings emerged from the focus group discussions. Focus group analysis indicate that placing students into a learning community provides the academic and social integration necessary for entry-level STEM students to persist in a historically challenging academic pathway. Notably, conversations around students' sense of community were often discussed in the context of help-seeking. For example, opportunities to connect with peers and faculty outside of the academic setting were perceived to strengthen community and increase comfort in seeking necessary help to persist in various courses. Additionally, students provided personal accounts of experiencing strong bonds with peers and faculty that positively impact their sense of belonging, persistence, and ability to leverage inherent strengths – collectively contributing to a cohort culture of collaboration and enhanced work ethic.

With the measured gains in student success, self-efficacy, and identifying with their path in engineering, the ETS program has shown preliminary success in achieving these main outcomes for students. The team will continue to provide special attention to getting students connected to each other and continue building the teamwork and communication skills essential to strong academic success, rewarding careers, and fulfilling lives.

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