

## **Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) Engineering Scholars Program at a Two-Year College: Preliminary Interventions and Outcomes**

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Karen Willis has been teaching mathematics at the two-year community college level for 6 years, as well as 3 years at the university level. Karen has several years of experience in tutorial coordinating and tutor training, as well as participating as a faculty mentor for engineering scholars. She loves to foster collaboration in the classroom between students so they can learn to work and grow together.

# Scholarships in Science, Technology, Engineering and Mathematics (S-STEM) Engineering Scholars Program at a Two-Year College: Preliminary Interventions and Outcomes

## Introduction

The Engineering Scholar Program (*Enhancing the Transfer Experience through a Collaborative Cohort Program for Fresno City College Engineering Scholars*, Award #1833999) at Fresno City College (FCC) is in Year 2 of the five-year project intended to increase persistence of engineering students along pathways to transfer and graduation from four-year universities. The first year coincided with the onset of the COVID-19 pandemic which brought unexpected challenges. However, Year 1 was overall quite successful and very informative for the program. Feedback from Year 1 evaluations (summarized in Box 1) informed our activities for Year 2, resulting in adjustments to mentoring practices and mentor training, undergraduate research topics, and seminar schedules.

### Key Year 1 Findings from Student Surveys

- 100%** felt more motivated to complete their degree
- 89%** felt more motivated to transfer to a 4-year institution
- 89%** felt they gained tools to be more successful in their degree programs
- 80 – 100%** found various seminars on engineering and engineering research to be **useful** or **very useful**
- 57%** found the seminars on college finances and time management to be only **somewhat useful**
- 100% gained an understanding of:**
  - How scientists and engineers work on real-world problems
  - How engineering research is conducted
  - How data are analyzed and findings documented
- 75%** increased their skills in interpreting findings from scientific studies
- 88%** had an increased interest in engineering careers and research

**Box 1: Summary of Year 1 evaluation key findings**

## Demographics

FCC is a two-year college located in the center of Fresno, California - one of the most racially and ethnically diverse regions in the state. Fresno's population of approximately 500,000 residents faces challenges of concentrated poverty [1,2] and low levels of educational attainment. Only 20.5% of adults over the age of 25 in Fresno have a bachelor's degree or higher and, 30.0% of the city's total population lives poverty [3].

FCC is a Hispanic-Serving Institution (HSI), an Asian American and Native American Pacific Islander-Serving Institution (AANAPISI), and serves a significant number of socioeconomically disadvantaged students. Enrollment for fall 2020 at FCC was 21,268; 61% of these students qualified as low income with annual household incomes at or below 150% of the U.S. Department of Health and Human Services Poverty Guidelines. The FCC Engineering Scholars

program is open to students majoring in engineering and exhibiting financial need. In fall 2020 there were 511 active engineering majors and 331 (61%) of them qualified as low income [4].

***Award Schedule***

As proposed, scholarships in the amount of up to \$6,097 each are awarded to cohorts of up to eight students per year, and are renewable for up to two years providing students maintain eligibility. Eligibility requirements include that students are U.S. citizens, permanent residents, nationals, or refugees; demonstrate financial need; are enrolled full time at FCC with a declared major in engineering; maintain at least a 2.75 GPA; are eligible for, or have already completed Calculus 1; agree to attend bi-weekly program seminars (75% attendance is required, and participation flexibility is accommodated); and commit to regular meetings with faculty and peer mentors.

Table 1 shows planned scholarship awards for Years 1 through 5.

**Table 1: Program Scholarship Awards by Project Year (Proposed)**

	Year 1	Year 2	Year 3	Year 4	Year 5
<b>FCC</b>	Cohort A (8)	Cohort B (8)	Cohort C (7)	Cohort D (7)	
		Cohort A (8)	Cohort B (8)	Cohort C (7)	Cohort D (7)
<b>Fresno State</b>			Cohort A (1)	Cohort B (1)	
				Cohort A (1)	Cohort B (1)
<b>Total Awards</b>	8	16	16	16	8

Awards are disbursed by semester allowing us to respond to changes in scholar eligibility, e.g. changes in financial need, students transferring out of FCC, changing majors, or dropping to below full-time status (exceptions for full time status were permitted during the COVID-19 pandemic). Table 2 shows the number of awards given in the first two years of the program.

**Table 2: Program Scholarship Awards by Project Year and Semester (Actual)**

	Year 1 (2019/2020)		Year 2 (2020/2021)	
	Fall 2019	Spring 2020	Fall 2020	Spring 2021
<b>FCC</b>	Cohort A (8)	Cohort A (8)	Cohort B (11)	Cohort B (9)
			Cohort A (4)	Cohort A (4)
<b>Total Awards</b>	8	8	15	13

Awards will be made for student scholars at both FCC and Fresno State starting in Year 3 as proposed.

### ***Program Goals and Objectives***

The goals of the Engineering Scholar program are broad and focus on the FCC Engineering program and its overall impact. The Engineering Scholar program includes faculty professional development and mentor training, faculty and staff networking across disciplines and campuses, recruitment and advertising campus-wide and within local high schools, and seminar, event, and workshop opportunities for the scholars. These activities support the program goals to: 1) create a diverse and welcoming STEM climate on the FCC campus through events and media that encourage broader participation, 2) increase participation in engineering among economically disadvantaged students through targeted outreach and recruitment, 3) increase persistence of engineering students along discipline specific pathways to transfer and graduation from four-year universities through a series of structured support interventions, and, 4) establish on-going collaborative transfer support processes between the FCC engineering program and California State University – Fresno (Fresno State).

The objectives of the Engineering Scholar program are to provide clearly defined, efficient pathways for students to progress towards their engineering degrees beginning at a community college.

Specifically, the objectives are to:

- 1) *Increase engineering degree and/or certificate completion rates at FCC over the project timeline.* The average 2-year completion rate for engineering students at the time the S-STEM proposal was submitted (March 2018) was less than 1%. The objective is to see this number increase to 5% over the project timeline.
- 2) *Accelerate student progression through the engineering curriculum at FCC, reducing average time to degree or transfer over the project timeline.* The average time to degree or transfer at the proposal submission was 10.4 semesters. The objective is to see that reduced to 8 semesters over the course of the project. And,
- 3) *Increase 2-year engineering transfer rates from FCC to four-year institutions.* The starting 2-year transfer rate was less than 8% and variable from year to year; our objective is to see a consistent 10% annual transfer rate by the end of the program.

The FCC Institutional Research, Assessment, and Planning Office tracks institutional data for each objective, summarized in Tables 3, 4, and 5.

**Table 3: Fresno City College Engineering degree and certificate two-year completion rates by Student Group. Student Groups include all students who claimed an engineering major by the end of the identifying fall term.**

<b><i>Program Objective 1: Engineering degree and/or certificate completion rates at FCC</i></b>			
<b>Student Group Year</b>	<b># of First Time Students with Active Engineering Major</b>	<b>Graduated within 2 Years</b>	
		<b>#</b>	<b>%</b>
2012 Fall	171	0	0.0%
2013 Fall	201	0	0.0%
2014 Fall	149	1	0.7%
2015 Fall	173	0	0.0%
2016 Fall	225	0	0.0%
2017 Fall	179	0	0.0%
2018 Fall	147	0	0.0%

The results show no improvement. Beginning next year we will also track 3-year completion rates. With the new degree and certificate options at FCC and the enhanced academic advising we expect to see both 2- and 3-year completion rates increase over the remainder of the project timeline.

**Table 4: Average number of semesters taken for students to earn a Fresno City College Engineering degree or certificate.**

<i>Program Objective 2: Time to degree and/or certificate for engineering students</i>			
Award Year	# of Awards	Average # of Semesters (excluding summer)	
		Mean	Median
2012-13	1	12.0	12.0
2014-15	2	13.0	13.0
2015-16	2	4.5	4.5
2016-17	1	8.0	8.0
2018-19	1	10.0	10.0
2019-20	17	10.9	8.0
<b>Overall</b>	<b>24</b>	<b>10.4</b>	<b>8.0</b>

Raw averages shown in the “Mean” column do not reflect the change that we are hoping to see; the overall average for the last eight years is 10.4 semesters taken to achieve a degree or certificate in engineering at FCC. Our goal is to see this number reduce to 8 within the project timeline. Median values for the data give encouraging results as seen in the last column. Seventeen awards were made in the 2019/2020 academic year and the median time to degree was 8 semesters. We expect to see the overall raw average come down as pathways and roadmaps are made more accessible to students and awards continue to increase.

**Table 5: Fresno City College engineering student 2-year transfer rates by Student Group. Student Groups include all students who claimed an engineering major by the end of the identifying fall term. A student is considered "transferred with 2 years" if the student enrolled in a 4-year institution by the end of the second year following the cohort fall semester. For example, a 2012 fall cohort student will be considered transferred if this student enrolled in a 4- year institution by the end of 2014.**

<i>Program Objective 3: 2-year engineering transfer rates from FCC to 4-year institutions</i>			
Student Group Year	# of First Time Students with Active Engineering Major	Transferred within 2 Years	
		#	%
2012 Fall	171	10	5.8%
2013 Fall	201	9	4.5%
2014 Fall	149	10	6.7%
2015 Fall	173	12	6.9%
2016 Fall	225	14	6.2%
2017 Fall	179	10	5.6%
2018 Fall	147	4	2.7%

The results do not show significant improvement, and rather actually include a large drop in the 2-year transfer rate for the 2018 Student Group. This large drop is likely exacerbated by the COVID-19 pandemic. Beginning next year, we will also track 3-year transfer rates for FCC engineering students. Our objective is to see less variability in annual transfer rates, and to see those rates at or above 10% by the end of the program timeline.

### ***Program Components***

In addition to scholarship money, Engineering Scholar cohorts are provided with a suite of support interventions including workshops, seminars, field trips, faculty mentoring, peer mentoring, academic advising, and participation in undergraduate research in collaboration with faculty at Fresno State.

#### **Key Components**

- *Academic Advising:* The scholars meet with the FCC Transfer Center Director each semester to update their SEP and review and discuss transfer application deadlines.
- *Mentoring:* They are assigned a faculty mentor from physics or mathematics with whom they meet at least monthly. Beginning Year 2, preceding cohorts serve as peer mentors for succeeding cohorts and meet at least monthly. Any students on academic probation (GPA fallen below 2.75) are provided with additional, twice monthly, half-hour mentoring meetings with the PI.
- *Undergraduate Research:* They engage in a series of scaffolded learning workshops and seminars with sociology and engineering faculty on multi-semester undergraduate research projects.
- *Seminars and Events:* Students are provided with additional opportunities each semester; e.g. to attend local professional conferences, engineering panel presentations, professional development workshops, to participate in outreach activities, and tours of California High Speed Rail construction sites.



**Figure 1. FCC Engineering Scholars program components**

### ***Year 1 Summary Overview***

The first Cohort of scholars was awarded in August 2019. We received 23 completed applications which were evaluated by the scholarship selection committee. The top eight eligible students were awarded. During the start of Spring 2020 one scholar dropped out of the program and to less than full time status to focus on working increased hours at their internship. We were able to award the remaining funds from that award, the second half of the spring allocation (\$1,524), to the next in line eligible student from those who applied.

The program began with Mentor training in August 2019 with a half day in-person training session provided by the Fresno State Center for Faculty Excellence (CFE). An additional four-hours of on-line training was provided through Canvas. All mentors completed the training. In person training included three sessions focused on 1) working with engineering students, 2) addressing equity and inclusion in engineering, and 3) technology aided student engagement.

The following online training provided via Canvas consisted of discussions on implicit bias, the experiences of female and LGBTQ engineering students, and ways to build relationships among Latinx students.

Each semester began with Program Orientation. All mentors and scholars attended, as well as the academic advisor for the program. The events lasted between 60 and 90 minutes. Program eligibility requirements and expectations were laid out, scholars and mentors were given the opportunity to introduce themselves and their hopes and expectations for the program. In Year 1 faculty mentors were assigned to scholars by the scholarship selection committee without direct input from the scholars. A highlight of Program Orientation each semester is the opportunity for students to meet and engage with the Engineering Scholar program academic advisor, who is also the FCC Transfer Center Director.

Faculty mentors were matched with students during program orientation. Two students were paired with each of the four faculty mentors. Scholars met at least monthly with their faculty mentors. The frequency and duration of meetings varied significantly depending on each scholar's particular goals within the mentoring relationship; some scholars met with their mentors as often as weekly, while others met for only 30 minutes one time each month. Mentoring activities in Year 1 were mostly focused on relationship building and discussions about scholar's academic goals, transfer plans, career aspirations, as well as challenges of difficult coursework.

Students participated in seminar activities, including field trips and volunteer educational outreach opportunities, and participated in undergraduate research in collaboration with Fresno State. Year 1 activities are summarized in Table 6.

**Table 6: Engineering Scholar Program Year 1 Undergraduate Research Workshop, Seminar, and Event Summary**

Year 1 Undergraduate Research, Seminars, and Events	Date and Duration	Location	Program Faculty				
			Program Director (PI)	UG Research Faculty (Engineering, CSU-F)	UG Research Faculty (Engineering, FCC)	UG Research Faculty (Sociology)	Academic Counselor
Program Orientation	8/16/19, 1.5 hours	FCC	x		x	x	x
Sociological Perspective; Research Methods	8/23/19, 1 hour	FCC				x	
Introduction to Engineering Research	8/30/19, 1 hour	FCC			x		
Time Management & Study Skills	9/6/19, 1 hour	FCC	x				x
Concrete Fundamentals; Knowledge; Application	9/11/19 1 hour	CSU-F		x			
Research Methods; How to Read Academic Journals	9/20/19, 1 hour	FCC				x	
College Finances & Budgeting	9/27/19, 1 hour	FCC	x				x
Mix Design; Knowledge; Analysis	10/2/19 1 hour	CSU-F		x			
Material Properties; Literature Review	10/11/19, 1 hour	FCC			x		
Field Trip: California High Speed Rail, Engineering Panels and Construction Site Tours	10/18/19, 6 hours	CA HSR Authority	x				
Social Problems: Identify, Analyze & Troubleshoot	10/25, 1 hour	FCC				x	
Testing Material Properties; Experiments; Analysis	10/30/19 1 hour	CSU-F		x	x		
Concrete Placement; Problem Solving	11/13/19 2 hours	CSU-F		x	x		
Current Research: Discussion & Analysis	11/22, 1 hour	FCC				x	
End of term celebration	12/6/19, 1.5 hours	FCC	x		x	x	x
Field Trip: CSU-Fresno Geomatics Engineering Conference	1/24/20, 4 hours	Convention Center	x				
Engineering Lab Reports	2/7/20, 1 hour	FCC			x		
Material Testing	2/12/20, 1 hour	CSU-F		x	x		
FCC/Chevron Women in Engineering Day, High School Outreach Event	2/21/20, 6 hours	FCC	x		x		
Ethics and Social Responsibility	2/28/20, 1 hour	FCC				x	
Quality Control Lab	3/5/20, 1 hour	CSU-F		x			
Field Trip: UC Merced Science Facility Tour	3/13/20, (CANCELED)		x				
Ethics and Social Responsibility	3/27/20, 1 hour	Zoom				x	
Engineering Research: Testing	4/15/20, (CANCELED)			x			

### Year 1 Evaluation Findings

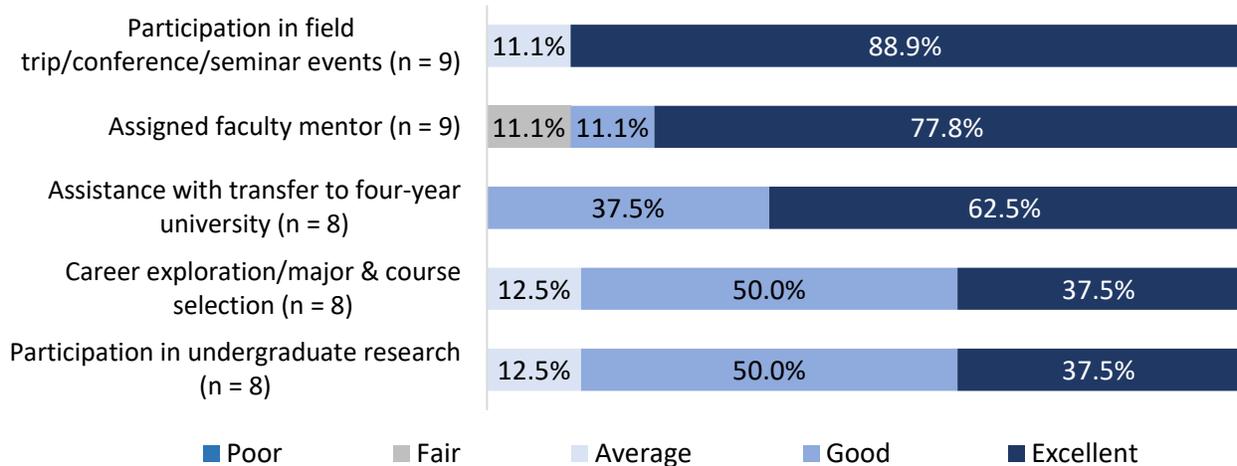
Nine students in Cohort A completed a survey in spring of 2020. The survey contained a mix of Likert-scale and open-ended responses gathering perceptions of the program. Students responded to questions about the effectiveness of the various program components including faculty mentoring, seminars, undergraduate research, and participation in extracurricular field trips and conferences.

#### *Perceptions of Program Quality*

The majority of students indicated that they chose to participate in the Engineering Scholar program because of their interest in transferring to a four-year institution and/or in pursuing a career in engineering. The majority also wanted to learn more about engineering research.

Students rated the overall quality of the Engineering Scholar program in providing them with support to reach their academic goals as *excellent* (77.8%), or *good* (22.2%). All indicated they would recommend the program to a peer. When asked to rate aspects of the program, the majority rated all components as good or excellent. Students rated participation in field trips and faculty mentoring highest, followed by assistance with transfer, career exploration, and participation in research (Figure 2).

*“The ability to do research with a professor from a four-year university prepared me for transferring and adjusting to a different teaching style. Encouragement from peers and faculty also motivated me to complete my transfer.”*  
 -Engineering scholar, 2020



**Figure 2. Student Ratings of Year 1 Program Activities**

In open-ended responses scholars particularly appreciated:

- Opportunities to connect and network with classmates and professors, including professors at four-year universities;
- Learning about engineering beyond academic contexts (e.g., research, volunteering at Women in Engineering Day conference, insights into the engineering profession);
- Assistance with transferring to a four-year institution; and
- The care and support from the mentors and program faculty.

Most scholars did not have recommendations for improvement of the Engineering Scholars program. A few recommendations included:

- Incorporating engineering competitions for scholars
- Improving the structure and instructions of the research component
- Including more technology-based projects

## ***Faculty Mentoring***

Subsequent sections of the survey allowed students to provide more detailed feedback on the major program components. All of the scholars felt that mentoring helped them to feel more motivated to complete their degree at the college, and felt supported both academically and personally. The majority (88.9%) indicated that faculty mentoring helped them feel motivated to transfer to a four-year institution, and that it

*“[My mentor] supported me through some tough times, both academically and career based, and helped me understand that struggling is a part of this degree, thus I should not feel alone.” - Engineering scholar, 2020*

helped them gain a better sense of how to be successful in their current degree (88.9%). Open-ended responses showed that scholars appreciate the support from members in assisting them with course work, providing resources to help them be successful in their classes and supporting them in their degree pathways. They felt that mentors encouraged them to persist, helped them manage personal and academic challenges, and gave them insight into their future careers. Scholars offered a few suggestions for improving mentoring, including more frequent meetings between mentors and scholars, ensuring compatibility of mentors and faculty members, and having meeting topics or projects to work on together.

## ***Undergraduate Research***

*“Being able to participate in a professional experiment, mirroring how a career will be in the engineering field helped me feel more reassured with my path and motivated in seeking out more experiences.” - Engineering scholar, 2020*

When providing feedback on the undergraduate research experience offered through the program, all scholars (100.0%) felt that the experience increased their understanding of how scientists and engineers work on real world problems, how research is conducted, and of data analysis. The majority (87.5%) also indicated that the research experience increased their interest in engineering research and in an engineering career (88.9%).

In open-ended responses, scholars were highly positive about the research experience. Participating scholars described many benefits including understanding what it is like to participate in a real-world engineering research project, learning that engineering is multidisciplinary, and learning research methods. They also cited personal growth related to the experience including feeling more confident and prepared with respect to engineering and problem solving, and feeling motivated to seek more research experience. Suggestions for improving the undergraduate research experience included offering more varied research projects, and clarifying student expectations.

## ***Seminars***

Seminars are an integral part of the Engineering Scholars program. They are designed to increase students’ understanding of engineering research including the sociological aspects of conducting research. Engineering sociology seminars including topics such as engineering research ethics, research methods, identifying social problems addressed by engineers, and how to read academic journals. Scholars rated the usefulness of these seminars on a five-point scale from *not at all useful* to *very useful*. Of those attending the seminars, scholars reported that all were *useful* or

*very useful*. The majority of students also rated engineering research seminars as *useful* or *very useful*, including topics such as Engineering research testing, quality control, lab reports, ethics and social responsibility and seminars related to content knowledge about concrete mix design and testing.

Students also participated in seminars intended to support their success in college. These included seminars on college finances and budgeting, and time management and study skills. In contrast to the professional seminars, the majority of students (57.1%) rated these as only *somewhat useful*. These seminars were kept in the program for Year 2 despite this mediocre rating. Cohort A included several students further along in their academic career and older than the traditional college freshman for whom the seminars were designed. The seminars will be reevaluated after Year 2.

## **Year 2**

In fall 2020 four of the students from year 1 cohort A continued in the Engineering Scholars program and an additional 11 students were awarded from a new pool of applications to establish cohort B. Two students from cohort B transferred to four-year schools in Spring 2021 reducing the cohort size to 9, shown in Table 2.

Student feedback from the Year 1 program evaluation informed adjustments to the program with regard to how mentors were assigned, how seminars were scheduled, and how the undergraduate research opportunities were designed and implemented.

### ***Mentoring and Mentor Training***

Research and evaluation results from Year 1 indicated that faculty mentorship increased students' sense of belonging, resulted in encouragement to persist, supported them through managing personal and academic challenges, and ultimately empowered students to describe themselves as contributors to the STEM disciplines. Students reported that improvements to mentorship should include additional mentorship structure, increased meeting frequency, and strategic mentorship pairing.

In pivoting towards a more formal mentorship approach for Year 2, ready-made materials for a mentorship training program were not available to meet the unique needs of two-year community college faculty mentors, thus it became necessary to develop and implement guided mentorship program specific to Engineering Scholar program mentors. Results from the first semester of the guided mentorship program indicate that the new mentorship materials were used with success, and subsequent mentorship trainings should be provided as faculty mentors reported interest in additional mentorship material engagement. Student feedback indicated that mentorship continues to provide critical support and is among the greatest benefit of the of the program for encouraging scholars to persist. The mentor training and results are being presented in a paper in the Two-Year College Division at the 2021 ASEE Annual Conference and Exposition.

### ***Seminars, Events, and Undergraduate Research***

Program seminars are designed to help scholars develop academic, personal, and professional skills. Program orientation is a key event used to begin each semester. It brings all of the students, faculty and research mentors, as well as the academic advisor together to set the tone and plan for the semester's activities.

The events for Year 2 are shown in Table 7.

The Time Management / Study Skills and College Finances and Budgeting seminars were continued even though they received a "somewhat useful" rating in the Year 1 evaluation. These events were continued and assigned only to cohort B students. The majority of cohort B students were first semester freshman just out of high school, which is the target audience for these seminars. Preliminary feedback from students for Year 2 was positive.

Professional development opportunities were provided for both cohorts in collaboration with the Society of Hispanic Professional Engineers (SHPE). Students were given access to and encouraged to attend two professional engineering conferences in Year 2: Fresno State Lyles College of Engineering 60<sup>th</sup> Annual Geomatics Conference and the SHPE Regional Leadership Development Conference.

The majority of workshops and seminars for Year 2 were focused around the undergraduate research opportunities in collaboration with Fresno State. The undergraduate research project activities are designed to foster among the Engineering Scholars 1) understanding of how scientists and engineers perform their research, 2) exposure to engineering research, and 3) increased interest in STEM fields. These goals are realized through the collaborative efforts of the program's research faculty mentors from both the Fresno State and FCC campuses. Technical specifications for the research are designed by a Fresno State Assistant Professor of Geomatics Engineering. A Sociology Instructor from FCC helps students connect the dots between socio-cultural content and engineering-led problem solving related to the semester project. The third leg of the research mentor team is an Engineering Instructor from FCC whose workshops and seminars aim to make the research content more accessible to the Engineering Scholars through research fundamentals, complementing the seminars of the other research mentors.

In fall 2020, the undergraduate research project goals were to lay the foundations of research methodologies, technical documentation, sociological perspective, computer programming, and engineering research using digital cameras. The Engineering Scholars participated in a variety of virtual seminar settings including discussion, lecture, and hands-on laboratories. Spring 2021 seminars build upon fall 2020 to include issues faced by our local communities. Students are guided to see how scientists and engineers view and approach these problems through the application of Remote Sensing methodologies. The primary focus is on the analysis of local issues such as natural disasters (wildfires, floods, earthquakes, etc.) and pollution through sharing consequent community impact. The secondary focus is on teaching and guiding students to represent their research project findings in the form of a research poster.

**Table 7: Engineering Scholar Program Year 2 Undergraduate Research Workshop, Seminar, and Event Summary. All Year 2 events were held virtually due to the COVID-19 pandemic.**

Year 2 Undergraduate Research, Seminars, and Events (All events were held virtually)	Date and Duration	Program Faculty				
		Program Director (PI)	UG Research Faculty (Engineering, CSU-F)	UG Research Faculty (Engineering, FCC)	UG Research Faculty (Sociology)	Academic Counselor
Program Orientation	8/14/20, 1.5 hours	x	x	x	x	x
Sociological Perspective (Cohort B only)	8/28/20, 1.25 hours				x	
Engineering Research Methodology and Digital Cameras	9/4/20, 1.25 hours				x	
Time Management & Study Skills (Cohort B only)	9/11/20, 1 hour	x				x
Geometry and Digital Cameras	9/18/20 1.5 hours		x			
Trigonometry and Cameras using Octave Programming	10/2/20, 1.5 hours			x		
Ethics and Digital Imagery	10/9/20, 1.25 hours				x	
College Finances & Budgeting (Cohort B only)	10/16/20, 1 hour	x				x
Taking Measurements using your Phone	10/23/20 1.5 hours		x			
Digital Cameras and Technical Documentation	11/6/20, 1.5 hours			x		
Photogrammetry and Remote Sensing	11/20/20 1.5 hours		x			
End of term celebration	12/4/20, 1.5 hours	x	x	x	x	x
Program Orientation	1/15/21, 1.5 hours	x	x	x	x	x
Natural Disasters and Community Impact	1/22/21, 1 hour				x	
CSU-Fresno Geomatics Engineering Conference	1/29/21 – 1/30/21	x	x			
Introduction to Remote Sensing and its Applications	2/5/21, 1.5 hours		x			
Remote Sensing Hands-on Lab (Vegetation, Water, Snow, Wildfire Analyses)	2/19/21, 1.5 hours		x			
Remote Sensing and Local Issues	2/26/21, 1 hour				x	
Society of Hispanic Professional Engineers (SHPE), Professional Development	3/12/21, 1.25 hour	x				
Academic Research Poster Development	3/19/21, 1 hour			x		
SHPE Regional Leadership Development Conference	4/15/21 – 4/17/21	x				
Remote Sensing Projects – Technical Issue Troubleshooting	4/16/21, 1.5 hours		x			
Research Poster Discussion	4/23/21, 1 hour			x	x	
End of Year Celebration	5/7/21, 1.25 hours	x	x	x	x	x

### Long-Term Plans

The intellectual merit of the project will be assessed with the following research questions:

1. How does participation in collaborative cohort experience contribute to students' membership within a STEM community?
2. In what ways do students use community membership to construct their own STEM identity?

To answer these research questions, we are taking phenomenography-informed approach to understand how students experience, conceptualize, and understand aspects of their movement from periphery to centrality within a community of practice and how their own STEM identity develops during this process [5]. Research will be conducted in two sequential phases: phase 1

will establish a community of practice and phase 2 will engage students in critical reflections implemented throughout students' cohort participation. To-date we have examined the role of mentorship in driving community development and its impact on the formation of STEM identity of students preparing to transfer from a community college to a four-year institution. Students from both Cohort A and Cohort B provided midpoint feedback during the Year 2 fall semester through a written response to the same question prompts from year 1. Mentors were also asked to provide written feedback on their mentoring experience thus far in Year 2, reflecting on the training videos, entering mentoring, goals and expectations, mentoring map, and mentoring meeting log worksheets. At the end of Year 2 we will review mentorship training approach and determine if any adjustments are needed. We will also engage the student participants in a second set of interviews to understand role of the Engineering Scholar program community in impacting the development of their STEM identity and sense of belonging in the STEM community. These results are being presented in a paper in the Two-Year College Division at the 2021 ASEE Annual Conference and Exposition. Future results will be submitted to engineering education journals to share what we have learned about the role of mentorship in STEM community development and identity formation of students at two-year institutions preparing to transfer to a four-year university.

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