

Analyzing the Impact of Professional Society Engagement on Community College Student Success in STEM

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Abstract

Research has shown that few community college students engage with STEM professional societies, often due to limited time and financial resources. This is particularly true for women, who are underrepresented in many STEM fields – specifically, in engineering and technology [1]. With more students beginning their postsecondary education at a two-year college, encouraging and supporting them through transfer to complete their bachelor's degrees is critical to addressing the lack of gender diversity in STEM.

This study focuses on women in community college who participate in a program that offers free membership to the Society of Women Engineers (SWE), to introduce them to women in engineering and technology, and provide a sense of community to support them through transfer and into their STEM careers. This longitudinal mixed-methods research is in its second year of a three-year study, utilizing data from the National Student Clearinghouse and interviews to determine whether membership in SWE influences students' decisions to declare a STEM major and transfer and complete a STEM degree. The findings from this research will influence professional STEM societies and higher education institutions in developing ways to encourage greater engagement among community college students to support their continued STEM involvement.

Purpose of the Study

In 2012, a summit report from the National Research Council and National Academy of Engineering noted that “community colleges are an often overlooked but essential component in the U.S. STEM education system” [2]. Almost 40% of U.S. undergraduates attend community college [3]. However, relatively few community college students go on to four-year programs: only 33% transfer, regardless of major [4].

Many women begin their postsecondary education at a community college, so encouraging and supporting them on the transfer pathway is critical for addressing the lack of gender diversity in STEM – particularly in engineering and technology. Indeed, the National Academy of Engineering (NAE) has highlighted the importance of community colleges in broadening participation in engineering because of the diversity they represent [2], [5]. Women in community college may face particular barriers in pursuing careers in engineering and computer science. Research has found that women students who begin their studies at a two-year institution have higher rates of switching out of engineering and computer science than men [6]. Further, research has found that women learn less about the engineering profession while in community college than men [1].

This study builds on prior research on engineering and computer science transfer students on the pathway toward a baccalaureate degree that we conducted from 2017 to 2020. Our research findings indicated that women in community colleges who declared a major in engineering or computer science were much more likely than men to switch out of those majors, with some colleges losing more than half of their female students [6]. This is particularly concerning because very few women select majors in engineering or computer science – our research found

that while almost 1 in 5 men across two-year and four-year institutions choose engineering or computer science majors, less than four percent of women do the same [6]. Coupled with our discovery that only half of women who transfer and major in engineering or computer science complete degrees in these disciplines [6], more support is needed for women in community college seeking to enter careers in these fields.

Community college students are less likely than their university counterparts to belong to professional societies, which offer exposure to academic and professional networks, mentors, and career opportunities. In 2022, SWE received a grant to pilot a program to offer free memberships to community college students. Our funders for this program understand the importance of increasing networks and support for these students, as a vital talent pool necessary to meet the growing demand for STEM talent.

This research study examines the impact of SWE membership on students who benefit from our free membership program. To understand impact, we follow students who received free memberships on or after January 2023 to determine if they remain in a STEM degree program and, over time, successfully transfer to a four-year university to complete a STEM bachelor's degree. Our mixed-methods study includes interviews with community college student members to understand the benefits and drawbacks of SWE membership and how this membership supports them in achieving their educational goals. The findings from this research will help inform future programming offered by SWE and other professional societies interested in better serving the needs of community college students in STEM.

The program consists of two major components: free memberships that stay with students through their two-year program, after transfer, and into their first year of employment after graduation, and program stipends to two-year college SWE sections to support professional development and outreach activities. While our study focuses primarily on those students receiving free memberships through our program, the influence of the program stipends on their engagement within their college's section and the larger professional society is considered. This includes involvement in SWE's affinity groups, specifically the group focused on community college students, faculty, staff, and alumni, as they explore ways to engage with the two-year college community through various events and activities.

Research Questions

This study seeks to answer the following: Does membership in the SWE increase the persistence of community college students in STEM degree programs?

In addition to a quantitative analysis of educational data to determine persistence in STEM, we seek to also understand:

1. How does SWE membership support students' persistence, including through transfer to a four-year university and completion of a STEM degree?
2. What aspects of SWE membership do community college students find most beneficial?
3. What aspects of SWE membership do community college students find least beneficial or detrimental to their STEM educational pursuits?

Conceptual Framework

In this study, we explore the impact of exposing women in community college who are interested in engineering or computer science careers to members of a global professional STEM society focused on empowering women in engineering and technology. We frame our analysis on Archer et al.'s concept of "science capital" as a theoretical lens to explain why some students see themselves as "science persons" [7], [8]. This concept builds on Bourdieu's theory of cultural capital – that the relevant attitudes, knowledge, information, skills, and resources that an individual possesses contribute to one's power and progress [9]. An individual's social network can provide a level of support to help a student navigate and persist in their STEM educational journey.

Specifically, we explore the impact of exposing women in community college to women in the STEM workforce. Through their membership in SWE, we consider how this exposure influences their motivation and confidence to complete their STEM degrees.

Methodology

This longitudinal mixed-methods research is in its second year of a three-year study, utilizing data from the National Student Clearinghouse and interviews to determine whether membership in SWE influences students' decisions to declare a STEM major and transfer and complete a STEM degree.

Quantitative Methods

To obtain records from the National Student Clearinghouse, researchers are required to submit student names and birthdates. SWE does not collect birthdates as part of member registration. To obtain birthdates for this study, students who received SWE membership through our free membership program were invited to participate in a research study and, if they agreed, to provide their birthdates in a short survey, in accordance with IRB requirements. Students were sent an email invitation explaining the purpose of the study and offered a modest incentive for their participation. Incentives were not contingent on whether their educational records were matched and included in our study.

Researchers submitted student names and birthdates to the National Student Clearinghouse to obtain data on each student's educational journey. This data is used to determine whether students (1) pursue and remain in a STEM degree program, particularly within engineering or computer science, and (2) transfer from a community college to a four-year university. Researchers also look at whether students have obtained STEM credentials after receiving free SWE membership, such as a certificate, associate's, or bachelor's degree.

Researchers have obtained National Student Clearinghouse data three times: January 2025, June 2025, and January 2026. We consider students as a cohort, with Cohort 1 including students who joined SWE from January 2023 through August 2024, and Cohort 2 including students who joined from September 2024 through March 2025. Table 1 provides information about how the quantitative sample was obtained for this study.

For the purposes of this research, we consider a STEM major to be one that the National Science Foundation categorizes as a STEM major for the Louis Stokes Alliances for Minority

Participation (LSAMP).¹ This includes the following CIP codes: 01, 03, 04, 11, 14, 15, 26, 27, 30, and 40. To be considered an engineering or computer science major, we use CIP codes 11, 14, and 15.

The number of students included in our study each year increases as the number of students obtaining free memberships increases. Cohort 1 includes students who will be tracked for the full three years, from spring 2023 to fall 2026, Cohort 2 includes students who will be tracked for two years, from spring 2024 to fall 2026, and Cohort 3 will include students who will be tracked for one year, from spring 2025 to fall 2026.

Cohort	Date	Task and Results
Cohort 1: Membership start between January 2023 to August 2024	December 2024 to January 2025	- Email invitations sent to 100 students 35 students provided birthdates 28 student records were successfully matched by the National Student Clearinghouse
	June 2025	- Second attempt to recruit study participants: Emails sent to 65 students 11 students provided birthdates 9 student records were successfully matched by the National Student Clearinghouse
Cohort 2: Membership start between September 2024 and March 2025	April to June 2025	- Email invitations sent to 91 students, including those from Cohort 1 who did not respond 43 students provided birthdates
	January 2026	- Submitted 89 students (students from Cohort 1 and Cohort 2 who provided birthdates) to the National Student Clearinghouse 70 student records were successfully matched: Cohort 1 = 35; Cohort 2 = 35

Table 1: Obtaining a Quantitative Sample

Qualitative

One-on-one semi-structured interviews were conducted in spring 2025 with eight students from Cohort 1. Students who completed interviews were offered a modest incentive for their participation. Interview data were analyzed to understand the benefits and drawbacks of membership in SWE on students' pursuit of their STEM educational goals. Interviews were conducted virtually and were recorded and transcribed. Researchers used Dedoose to analyze the interview data and identify central themes. Researchers did not use AI to assist with quantitative or qualitative analysis for this study.

Results

As of the submission of this paper, we have completed the analysis of quantitative data for Cohorts 1 and 2 and qualitative data for Cohort 1. Qualitative data for Cohort 2 will be collected in spring 2026.

¹ This determination was made at the start of our research study, when IRB approval was obtained.

Quantitative Results

As of September 2025, 43% of Cohort 1 have transferred to four-year universities. Of these, 73% completed associate's degrees before transfer. Regarding majors, 86% of those who transferred and have reported majors listed in the NSC data set are majoring in a STEM field, and 83% of those STEM students are majoring in engineering or computer science. Only two students from Cohort 1 in our data set were no longer enrolled in a higher education institution, and one of those students had graduated with an associate's degree in an engineering discipline and did not transfer.

Of the 18 students from Cohort 1 who were still enrolled in a two-year program, 88% who had reported majors listed in the NSC data set are majoring in a STEM field, with 69% of them majoring in engineering or computer science. Two students were listed as general studies majors, which may mean that they have yet to declare a major.

From Cohort 2, 40% have transferred to a four-year university since receiving free SWE membership. Of these, 58% completed associate's degrees before transfer. Regarding majors, 83% of those who transferred and have reported majors listed in the NSC data set are majoring in a STEM field, and all of them are majoring in either engineering or computer science. There were four students from Cohort 2 in our data set who were no longer enrolled in a higher education institution. Two of them had left their two-year institution with STEM certificates. The others had not received a degree or certificate.

Of the 18 students from Cohort 2 who were still enrolled in a two-year program, all of them had reported majors listed in the NSC data, and 78% were enrolled in a STEM major. Of these, 86% were majoring in engineering or computer science.

Qualitative Results

To understand how SWE membership has helped support community college students persist in their STEM major and transfer to a four-year university to complete their bachelor's degree, we interviewed students who had received free memberships through our program.

Several students spoke of the sense of community that their membership offers:

"It's fun to see everyone because STEM is still male-dominated at school for the engineering-related majors. So it's nice when we get to all come together, and we're community college, so it's not like we see each other outside of class on a regular basis because we don't live on campus."

Many mentioned that participating in SWE activities makes them feel that they are not alone in a major that can often make them feel isolated. For example, this student spoke of her experience during a virtual event:

"... I just remember how I felt after I sent [a message] because in the chat you could also do reactions and there were a bunch of people that had put thumbs up and they were like, 'Oh my God, me too.' And then did their own little snippet to

their story or whatever, and I was like, 'Oh, wow.' It really just makes you feel less alone."

Others spoke of the impact of attending an in-person event:

"...the biggest support that I've received from SWE, it's emotional to be honest. It's emotional because my confidence about choosing the right career went up high when I had the opportunity to go to a conference and to actually meet a lot of people that are part of SWE."

"It feels like you are having a college experience, you are going to a conference, you are meeting people, and then you have a career fair there. You know that? Wow. And then you go back more motivated."

Some students discussed the importance of having an organization like SWE that offers role models, and seeing themselves as role models, for future engineers:

"I love that I'm breaking all the normal statistics as a Latina woman, first gen doing mechanical engineering. But I wish that one day there'll be a day where it'll just be normal.... It'll just be like if there was an elementary girl who really wants to be an engineer, she'll be able to look up and see people that are like her as well."

When discussing role models, a few students spoke specifically about the importance of having working engineers who are open about their community college past:

"I think when we hear from the folks that have actually gone through community college and then gone on to get their bachelor's and work as engineers, that's really impactful that you can see that you can do it."

When asked about the benefits of offering free SWE membership, several benefits were mentioned, from those often cited:

"I just hope this program continues to grow and is able to touch more girls in undergraduate and just reach more schools because I feel like it goes, even if you're not in it or necessarily an active member, to hear that your institution has a space reserved for women engineers, I feel like is empowering in itself."

"Definitely networking, help with resume stuff, finding internships, and finding out about new opportunities. I really enjoyed meeting the various companies and schools when I was at the conference. It was really neat."

to the more practical:

“Free pizza. There’s no cafeteria at my community college, so you either bring your lunch or you have to go off campus, and then when they have free pizza for some event and you get invited, you go.”

When asked about the challenges of professional society membership, students focused more on their challenges as a community college student in STEM:

“...If you have to work to pay your bills, you can’t go away for six to eight weeks during the summer to do internships.... So it’s really challenging trying to figure out how to get experience while needing to pay bills, not having the family support that can go off for the summer.”

“...Community college, they’re a great place, but the truth is we don’t have as much money as university. So the resources are very limited and that is the reality. That’s the truth.”

and on what a professional STEM society could offer to better support them:

“We don’t do a lot of [research posters] at school. [It would] be nice if there were a sort of initiative to have more community college projects that could develop posters, either at the regional or national conference.”

“I love the local conference. And the reason why, the national was great, yes, but the reason why is that it’s possible for more students to go. It’s possible for people to go.”

A concern that arose from one student who serves as a leader of her SWE section was focused on the sustainability of sections on community college campuses:

“The challenge we face is the transition of the board because we are in community college for two years, and two years goes by like this. And when you set a team and your group is getting stronger, in the blink of an eye you are graduating.”

Discussion and Next Steps

Community colleges are a critical part of the STEM ecosystem, and professional STEM societies have a role to play in better supporting students who begin their STEM journey at a two-year institution. We cannot wait until they transfer to a four-year university to provide the benefits of professional society membership if we truly want to support students throughout their STEM education. While it is true that students who attend community colleges face unique challenges that most four-year students do not have to contend with, there are ways to increase access to society offerings and open our communities to this student population. While prior research highlights the financial barriers associated with professional STEM society membership, this study offers us an opportunity to understand both the benefits of membership to community college students once financial barriers are reduced and the challenges that exist that may not be addressed in a “one size fits all” membership model.

While we are still collecting data and have yet to see any of the students who have benefited from our free membership program complete a four-year degree, our results to date offer an optimistic perspective on the impacts of membership in a professional STEM society on community college students, particularly for women pursuing degrees in engineering and computer science. Our research provides preliminary evidence supporting the value of membership in increasing persistence in a STEM major, as we can already see students successfully transferring from two-year to four-year institutions while remaining in STEM. Conversations with students who have received free SWE membership highlight the value they see from engaging in our programming, ranging from local on-campus activities to the events offered through our national headquarters. These benefits include a sense of community, less feelings of isolation, networking and career opportunities, and exposure to role models and mentors.

The next step in our study includes a second round of interviews with students from Cohorts 1 and 2 in Spring 2026. We will reach out to students in the summer or fall of 2026 to collect birthdates for a last round of National Student Clearinghouse data collection, with a final round of interviews planned at the start of 2027.

Our research findings will inform the development of new programming, the strengthening of existing programming, and possible adjustments to structural aspects of our sections to better accommodate community college participation. In addition, the results from this study support the continued investment in free memberships and program stipends to support community college engagement activities. We believe that other professional STEM societies will benefit from seeing the results of these investments and consider ways to better support community college students' participation in their organizations.

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