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Engaging Two-Year Students in STEM: A Professional STEM Society's Efforts to Support Community College Students

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Community college is a popular pathway for underrepresented students in STEM. Through a phased research study of STEM transfer students, researchers discovered that women in community college who declared a major in engineering or computer science were much more likely than men to switch out of those majors. In addition, community college students were less likely than their university counterparts to belong to professional societies, which offer exposure to academic and professional networks, mentors, and career opportunities. To address this, the Society of Women Engineers (SWE) created programming in 2022 to increase community college women's membership and support their engagement in societal activities. The program reduces financial barriers with free memberships and stipends for community college groups to host events and activities, engages community college students through a SWE affinity group, and offers virtual and in-person sessions at SWE events focused on two-year students.

This paper will discuss the programming design, process, and results to date, specifically focusing on whether the new offerings are increasing SWE's community college student membership and engagement and how the program is identifying and responding to challenges specific to this group given its diverse makeup and unique needs. The paper will also discuss additional challenges facing women on the community college pathway towards a STEM bachelor's degree, and the evaluation plan in place to track the retention and completion of community college student members' STEM degrees.

Background

In 2017, researchers from the Society of Women Engineers (SWE) sought to understand the success rates of students who began their postsecondary education at a community college in persisting and completing bachelor's degrees in engineering and technology. Their hypothesis was that community college women were moving out of these majors at higher rates than their male counterparts, a phenomenon that has historically been seen in four-year STEM programs [1]. With community colleges serving as a popular pathway for underrepresented students in STEM, efforts to increase diversity in engineering and technology professions must consider ways to increase success of students who begin their studies at a two-year college. Given that women represent only 16% of employed engineers and 25% of employed computer scientists, consideration and support of women in these majors in community college could be extremely influential in increasing their representation in these fields [2].

The results of the 2017 study supported the hypothesis that women in community college were leaving engineering and technology majors at higher rates than their male counterparts [3]. Though switching out of these majors is high for men and women, women are switching majors and earning bachelor's degrees in other fields at higher rates than men [3]. A follow-up study conducted in 2020 found that women in community college pursuing careers in engineering

and computer science learn less about engineering and technology professions while in college than men and have less confidence in their math and science skills than men - possible factors explaining why they are moving into other majors [4].

Almost half of Black, Hispanic, and American Indian undergraduate students are enrolled in community colleges, and more than 30 percent of undergraduate women students attend community college [5]. Notably, more than 80 percent of community college students indicate a desire to complete a bachelor's degree or higher, and those who do transfer have been found to have higher baccalaureate completion rates than students who begin their studies at a four-year university [6, 7, 3]. This is also true for students transferring in engineering and computer science, with women experiencing higher baccalaureate completion rates than men [3]. Unfortunately, only about 1 in 3 students make it to transfer, regardless of major [8], and less than 2 percent of women who transfer select engineering or computer science as a major compared to more than 10 percent of men [3].

Researchers have noted the importance of community colleges in addressing the diversity of the engineering workforce [9], but also acknowledge the numerous barriers they face throughout the transfer pathway [10, 11, 12]. When identifying the key supports necessary for effective transfer from community college to a four-year institution in engineering, researchers highlight the important role that professional engineering societies can play in the development of an integrated and coordinated transfer system [9, 13]. For women in particular, researchers highlight the need to address math confidence [14] and social and informational resources [15] to support their transfer and completion of an engineering bachelor's degree.

The 2020 follow-up study that SWE conducted included recommendations for institutional leaders, professional societies, industry partners, and other organizations interested in improving support for transfer students in engineering and computer science. Four of the recommendations were relevant to STEM professional societies: (1) Provide more financial support; (2) Provide more information about career pathways; (3) Strengthen interpersonal relationships, networking, and mentorship; and (4) Focus on boosting confidence.

These findings led SWE to consider ways in which they could better support women starting their engineering and computer science studies at a community college, to encourage them to stay in these majors, transfer, and complete their degrees in these fields. SWE's plans centered on the outcomes from their research; specifically, the role that the society should play in increasing community college women's knowledge about engineering as a career, building confidence and self-efficacy, and ensuring that they felt a sense of inclusion in engineering, despite often being one of few women in their STEM classes [16].

First, SWE added supporting students attending two-year colleges as a strategic priority in 2021. To this end, an affinity group was started in 2021 to encourage students, staff, faculty, and alumni from community colleges to come together to raise awareness of their unique challenges and offer a platform to amplify their diverse perspectives and contributions to STEM. The Community Colleges Affinity Group promotes community college women in

engineering, engineering technologies, and related STEM fields, showcases the impact of community colleges in the STEM landscape, and helps strengthen relationships between community colleges and four-year institutions, industry, and professional networks.

Second, grant funding was obtained in 2022 to support the creation of the Community College Affiliate Support and Expansion (CCASE) Program, providing free student and faculty memberships and program development stipends to fund speakers, outreach activities, and professional development opportunities for community college affiliates. An affiliate designation provides limited access to SWE benefits when student groups do not meet the eligibility requirements for a collegiate section. The CCASE Program was developed to encourage the creation of new community college affiliates and to increase the membership of community college students within the organization.

This paper provides an overview of the Community Colleges Affinity Group and the CCASE Program, including the design, process, and results to date. The paper also highlights the challenges that SWE has faced in growing its community college membership and engagement. As the CCASE Program continues to recruit new students to the organization, we consider the current and future plans to track retention and completion of students in STEM degree programs and their engagement with SWE.

Community Colleges Affinity Group

The Community Colleges Affinity Group (AG) was chartered in 2021 with a mission to "*promote and connect community college women in engineering, engineering technologies, and related STEM fields and raise awareness of their unique challenges and diverse perspectives and contributions, within SWE and beyond*". The AG supports and advocates for community college women in engineering and highlights the importance of community colleges in achieving diversity and inclusion in STEM. Key to its mission is celebrating the perspectives, experiences, and contributions of community college women in engineering; raising awareness of their unique pathways and challenges; and promoting belonging and visibility in SWE and in the broader STEM community. This includes changing perceptions of community college education and students and promoting the value of societal membership for community college students.

A fundamental component of AG efforts is increasing the number of community college students, affiliates, and participating institutions within SWE. The AG works with the CCASE Program to disseminate information about the program through activities and events, in conference presentations and networking, and in targeted messaging in social media posts and newsletters. The AG further works to support new applications for affiliates and CCASE funding and aims to share best practices and ideas for the use of CCASE funding for new and existing affiliates. In general, the AG aims to be a conduit for community college faculty who will, in turn, provide a pipeline of new student members and raise SWE's visibility on their respective campuses.

The AG organized two virtual Coffee Hours in FY24 to promote the CCASE Program and foster connections with new faculty advisors, institutions, and student members. The first: *Building*

Community College Engagement and Starting a New Affiliate Using CCASE (October 2023) was a collaboration between the AG and SWE staff to broaden community college participation in the professional society. Community college faculty, students, administrators, advocates, and supporters attended along with representatives from SWE's membership division, who fielded questions about starting an affiliate and obtaining CCASE funding. Experienced community college faculty advisors offered mentoring for new faculty advisors. The second Coffee Hour in January 2024 aimed to reinforce existing relationships, engage new members, renew focus on the CCASE Program, and offer AG support for new and existing affiliates.

Following the success of the virtual engagements during the prior year, the AG launched a series of four Coffee Hours for the 2024-2025 (FY25) academic year. The September and November sessions focused on helping community college students build a LinkedIn profile (*LinkedIn 101*) and the importance of representation for girls and women in STEM (*Promoting Inclusivity in STEM*), respectively. Currently in planning, the January 2025 session will offer strategies and tips from SWE professionals who have successfully built a constellation of local community college affiliates in Southern California. As with previous Coffee Hours, all sessions are outreach sessions that include a call for AG participation, new SWE affiliates, and applications for CCASE funding.

To highlight the impact of affiliates on community college students, faculty, and campus communities, the AG utilized CCASE funding to sponsor the *Community Colleges AG Video Challenge!* in spring 2024. This contest was developed as a platform to share community college voices and perspectives while promoting the mission of the AG, the importance of Society membership for community college students and institutions, and the impact of CCASE funding on broadening engagement and participation in the community college space. Two- to three-minute videos were submitted by community college faculty, students, and alumni and judged by a panel of judges. The CCASE Program funded prize money for winners.

At SWE's annual conference in 2023, the AG hosted an interactive presentation called "Building Community Around the Community Colleges AG". This presentation celebrated community colleges and community college women in engineering while brainstorming ways in which the AG could promote them within SWE. The CCASE Program was a focus of the presentation.

At the 2024 annual conference, the AG highlighted the CCASE Program in two ways: in a networking event and in an AG-sponsored panel composed of current community college students and recent alumni. The panel session, titled "Community College Voices: Let's Talk about Inclusion & Belonging in SWE,'' jumpstarted conversations about belonging and addressed barriers and challenges for community college women, both real and perceived, to full inclusion within SWE. In March 2025, the AG will present "SWE and Community Colleges: A Celebration of Reciprocity" at a SWE local conference. This presentation will explore how SWE enriches the lives of community college women and how community college women bring unique strengths that enhance SWE.

AG communications and messaging promote the CCASE Program with regular social media posts on its public LinkedIn and Facebook pages and in periodic newsletters that target SWE members. The AG also communicates regularly with other stakeholder groups within the society, including other SWE affinity groups and committees like the Women in Academia (WIA) committee.

For its efforts, the AG was recognized by SWE with a 2024 Silver Mission Award for growth and achievement aligned with SWE's core values and strategic goals.

CCASE Program

In 2022, the Amateur Radio and Digital Communications (ARDC) awarded SWE with a grant to support various societal activities, including the development of a new program to offer College-to-Career (C2C) memberships at no cost to community college students. While the mission of ARDC is to support, promote, and enhance digital communication and broader communication science and technology, to promote Amateur Radio, scientific research, experimentation, education, development, open access, and innovation in information and communication technology, ARDC was particularly interested in the two-year pathway into a four-year academic institution and retaining women interested in pursuing an engineering or technology degree. They were very interested in supporting community college students.

The C2C memberships offered through the CCASE Program are valid throughout a student's educational career (associate's, bachelor's, and graduate studies) and into the first year as a professional member. In addition, the grant supports up to $1,000 per year for community college affiliates to fund various professional development and outreach activities aimed at encouraging local networking and engagement between students and professionals. For example, one college has received a stipend to fund a speed networking event with students, local community members, and alumni.

When the CCASE Program first launched in early 2023, SWE staff worked with the Community Colleges Affinity Group (AG) to promote the program's offerings to existing and potential affiliates. SWE's membership database had few members who identified their community college attendance, making it difficult to utilize existing members outside of the AG as a recruitment tool. However, SWE promoted the CCASE Program through its social media channels and approached various organizations with ties to community colleges to share the program. SWE continues to promote the CCASE Program in these ways, but engagement has been a challenge.

To start an affiliate, at least one student member and a faculty advisor are required. It has been challenging to reach community college students to make them aware of the free C2C memberships. Students are often unfamiliar with the organization and are unclear of the benefits associated with membership. The CCASE Program has seen more success when a faculty member is engaged and can share the program with their students, but this places more of a burden on community college faculty members who are often less supported by their colleges than their four-year counterparts.

Once an affiliate is created, accessing free C2C memberships and professional development stipends is a simple process. Membership fee waivers are provided to students. A faculty advisor can submit a short application to request professional development stipends, which are then sent directly to the faculty advisor for use. After the event takes place, the affiliate is required to submit a brief report to let SWE know how the funds were spent and how many students participated.

Despite a slow start to affiliate recruitment, the ARDC provided additional funding to support the CCASE Program in 2024. In addition to free memberships and stipends, the CCASE Program now offers free conference registrations for SWE events. SWE and ARDC understand the challenges experienced, but they are encouraged by the modest growth experienced and the student stories shared.

Evaluation

Both the Community Colleges Affinity Group and the CCASE Program were launched in response to SWE's goals to increase program offerings for women in two-year colleges and to support student members through transfer to complete four-year engineering and technology degrees. The CCASE Program aims to increase the number of new community college affiliates. In its first year, the goal was to increase the number of new affiliates from 40 in 2022 to 54 by the end of 2023 - an increase of 35%.

Evaluation of the CCASE Program focuses on:

- The number of new affiliates created
- The number of student members who join through the free memberships
- The number of faculty members who join through the free memberships

In conjunction with the CCASE Program, the AG works to foster a local and supportive community and build a sense of belonging for women on the community college pathway. Engagement is currently measured through metrics associated with the AG's activities. Specifically, engagement is measured through:

- The number of people who attend AG events, including meetings and webinars
- The number of followers on the AG's LinkedIn account
- The involvement of community college members in SWE's events - including the regional and annual conferences

Researchers are currently developing a three-year research plan that will include tracking CCASE students to determine whether they are enrolling in and staying in engineering and technology programs, successfully transferring, and completing their degrees. In addition, SWE will interview students to more effectively gauge engagement with the CCASE Program, the AG, and SWE at large.

Results

Since the CCASE Program launch in January 2023, SWE has been tracking the number of new and reactivated affiliates and the number of students and faculty from community colleges who have become SWE members. In January 2023, the Society had 22 active affiliates and 18 inactive affiliates. Given that there are more than 1,400 community colleges in the United States, there is monumental potential for increased involvement between community colleges and the Society [17].

As of August 2024, the Society has seen an increase of 41% among new active affiliates (9 new affiliates). In addition, three inactive affiliates have been reactivated, thanks to the CCASE Program. Program stipends have slowly been utilized, as SWE staff and the AG work to promote the availability of these funds to support affiliate activities. To date, eight stipends have been awarded totaling $6,000, but more funds are available and await applications.

Community college student memberships have increased 70%, from 192 in January 2023 to 326 in August 2024. Community college faculty memberships have also increased, from 30 in January 2023 to 42 in August 2024, an increase of 40%.

Though free registrations to SWE conferences have only been available for four conferences in 2024, the response highlights the importance of addressing financial barriers associated with this type of SWE engagement. SWE hosted three regional conferences in Spring 2024, offering 30 free registrations across the three events. Of these, 20 were used to support student and faculty attendance. For the annual conference in October 2024, SWE awarded grants that covered the cost of 42 registrations.

SWE has started collecting reports from community college affiliates who have made use of the CCASE stipends. Affiliates note the critical role this program has had on their students:

> *"Those memberships allowed me and 8 students to attend [a SWE regional conference] because our school does not pay for individual memberships."*

They also note that offering financial support specifically for community colleges is a powerful way to recruit new affiliates:

> *"The program certainly 'sweetens the pot' for new affiliates with funding to jump start activities, but, more so, indicates SWE's commitment to expanding community college membership and participation."*

Offering financial support through SWE can also be used to encourage additional financial support from the college:

> *"Being able to bring some amount of money from an external source goes a long way towards helping us continue to receive college funding."*

In addition, two affiliates have written blog posts for SWE, describing how the funds have been used to revitalize their existing affiliates. One college shared that their affiliate had become inactive when the pandemic hit. CCASE funds were used to host a Meet & Greet for students to see if there was interest in restarting the affiliate. From that meeting, eight students became members and another seventeen expressed interest - and the affiliate was again active.

The second community college affiliate noted that typical recruitment efforts, such as flyers, emails, and posted announcements were ineffective in recruiting new student members. Instead, they have found that personal connections work best with community college students. Society members and academic advisors speaking directly with students majoring in engineering and inviting them to join SWE is much more impactful than emails and similar communications from the national organization.

In addition to the success seen through the CCASE Program, SWE has been tracking the engagement of community college students and faculty through the AG's activities. The AG has a growing LinkedIn group, currently with more than 600 group members. The group posts publicly and reaches a global constituency. Approximately seventy public posts in 2024 that promoted community college engineering pathways, the value of SWE affiliates for community college women, and resources like CCASE have garnered more than 58,000 post impressions.

Additionally, the AG routinely messages an email list of over 800 contacts and uses a SWE "opt-in" list of about 400 members to disseminate AG newsletters and resources for existing and new affiliates. Presentations at SWE's annual and local conferences raise the AG's visibility within the society, engaging a broader audience and a more diverse set of stakeholders. Activities such as AG Coffee Hours and planning meetings - typically attracting up to 25 attendees - further engage faculty, students, industry, and advocates; promote the CCASE Program; and offer mentorship for new affiliate faculty advisors. Four Coffee Hour sessions are planned for the 2024-2025 academic year.

Recently, the AG developed a working group structure that actively engages members in initiatives to improve alumni and industry relations, communication strategies, event and conference engagement, and member recruitment. Overall, the working groups support the AG's efforts to (1) promote the value of SWE for community colleges and (2) broaden community college participation by increasing the number of individual members, participating institutions, and new affiliates. To date, there are six working groups with a total of 20 members.

Issues and Challenges

SWE has experienced a few challenges in its efforts to increase membership and engagement among community college students. Despite growth in membership, the Community Colleges Affinity Group has struggled to increase participation in its various activities. Engagement in the AG's activities is vital to building inclusion and belonging among community college students within SWE. Though engagement has been relatively low, AG leadership continues to consider alternative ways to reach members and encourage them to engage with their events. The AG

promotes the CCASE Program and encourages community colleges to consider launching new SWE affiliates so that they can access CCASE Program stipends. Unfortunately, there is some hesitation from faculty members who may express interest in starting an affiliate but are concerned about the responsibility that comes with serving as a faculty advisor for their affiliate.

Challenges associated with the CCASE Program largely fall in three areas. First, SWE has limited networks among community colleges and with organizations that work with community colleges. Getting the word out about the availability of funds to support free memberships, program activities, and conference registrations has been difficult. Second, the effectiveness of communicating what the CCASE Program is and how to take advantage of the available funds has led to some confusion among those for whom the program was meant to serve. To combat this, SWE has been working to modify the messaging, program instructions, and application forms to provide more clarity and make the process as easy as possible.

Third - and possibly the biggest obstacle - is that many community college students do not understand the value and benefits associated with professional society membership. Despite SWE's efforts to share about the CCASE Program and the availability of free memberships, community college students are unclear about what membership entails beyond attending meetings. The most effective recruitment method for students appears to be when they learn about SWE from a trusted community college faculty, staff member, or peer. Students are then able to ask questions and gain a better understanding of the benefits of membership, including access to scholarships, internships, and job opportunities.

Program Changes

After the pilot year in 2023, many changes were made in 2024 to address the issues encountered with the CCASE Program. Based on feedback from community college students and faculty advisors conducted through surveys, the majority of those who applied for stipends wanted more funds for professional development workshops, events, and recruitment. On average, a community college affiliate would host 14 events yearly. For 2024, stipend amounts were increased from $750 to $1,000. Another highly requested change was for funding to be available for local conference attendance, both for events held virtually and in person. The CCASE Program now offers this benefit: free conference registrations to 55 community college students to attend SWE's local and annual conferences.

Approximately 60% of community college affiliates surveyed have less than ten members. As such, continued membership growth and yearly retention of members were both crucial to combat turnover. In 2024, the CCASE Program increased the number of memberships offered per affiliate from five to 10 and allowed affiliates to request more memberships on an annual basis. In response to feedback regarding confusion about how to apply for funding, the CCASE application and reporting process for memberships and stipends was simplified to reduce time and undue burden. Changes included collecting requests through two online forms instead of through email and paper forms, removing extraneous questions and data collection, and reducing approval times.

Future Directions

SWE believes in the importance of supporting community college students through degree completion, if we are to see greater diversity within the engineering and technology professions. The CCASE Program and the Community Colleges Affinity Group have shown modest growth since their inception. SWE will continue to support this growth and highlight the successes.

To this end, SWE has recently received funding from Honeywell to study the impact of the CCASE Program. The evaluation plan includes tracking the retention and degree completion of students who join SWE through the program using data from the National Student Clearinghouse. The study will include interviews with students to determine the impact of professional society membership on their educational pursuits, if any, and their level of engagement with the Society. This is a three-year study that will help the organization improve the CCASE Program, with the goal of engaging more community college students over the next three years. Results from the study may offer promising practices for other organizations interested in supporting students who begin their STEM studies at a two-year college. In addition, the findings could lead to institutional policy recommendations aimed at supporting student engagement with professional STEM societies pre-transfer to help smooth the transition from two-year to four-year institutions and into the professional workforce.

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