Shifting Perspectives: Motivational Factors for Young Women in Engineering and the Role of Student Organizations

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Abstract

The key factors that motivate young women to pursue engineering careers should be recognized and integrated across the educational system, from K-12 through graduate-level programs. Focusing on motivating factors highlights a fundamental shift from focusing on the obstacles that young women face to emphasizing the positive influences that foster interest and confidence in choosing to study engineering and enter engineering career fields. Current research in this area highlights seven specific factors which are positive influences that can be developed through informal learning experiences, such as clubs or enrichment activities. Research shows that young women who choose and stay in engineering [1, 2]:

- show a genuine interest in and positive attitude towards engineering
- value the field of engineering
- demonstrate engineering-related self-confidence
- embrace a STEM identity
- have a robust support system
- leverage personal and cultural resilience
- feel a sense of belonging within the engineering community

The Society of Women Engineers (SWE) student chapter at Oklahoma State University (OSU) plays an important role in supporting these seven motivating factors through intentional programming. Three years ago, the chapter overhauled its approach to programming in order to better support a broader perspective of the members' lives. In the context of the seven factors mentioned above, numerous examples are shown of how the organization provided innovative programming, support, and engaging activities around each motivational area. Additionally, survey data of members' perceptions of this student organization are included.

As a result of these comprehensive programming efforts, the SWE student chapter achieved a 55% increase in average meeting attendance over the school years 2022/2023 to 2024/2025. When compared with pre-COVID years, the increase is even more impressive – the chapter had 55 members in 2019/2020, experienced a steep decline in numbers after the COVID pandemic, then jumped to 154 members for the 2024/2025 school year. This result underscores the effectiveness of how focused programming in a student organization can impact and empower young women to engage in engineering-related activities which ultimately encourage them to pursue and stay in engineering.

Introduction

The underrepresentation of women in engineering continues to be an issue in today's society. While some progress has been made, women still constitute a minority of engineering students [3] and professionals [4]. This disparity is attributable to various factors, such as societal stereotypes, lack of role models, implicit and explicit biases and feelings of not belonging [5, 6, 7]. One way to address this disparity is to shift the focus in our educational and professional arenas from working on the obstacles women encounter to implementing an infrastructure which reflect the factors that motivate them to pursue and remain in engineering careers.

This report explores how the SWE student chapter at OSU integrated these motivational factors into their programming. Understanding how these factors can effectively and practically be implemented in student organizations is crucial for developing strategies that foster a more inclusive and supportive environment for women in engineering.

Motivational Factors for Young Women in Engineering

While many studies have focused on the barriers that prevent women from choosing or staying in engineering careers, recent research has flipped this approach. It was found that a different perspective - highlighting the key factors that encourage young women to enter and persist in engineering - is an effective framework for inspiring women to stay in engineering.

Research indicates that these motivating factors can be cultivated through both informal learning opportunities, such as involvement in clubs or extracurricular activities, as well as through formal engineering coursework. These factors can be developed during key "opportunity windows" at various stages in a young woman's life, providing critical moments for support and growth. These "windows" do not close once a student steps onto campus, as women will enter engineering majors while in college. Thus, the programming in student organizations on college campuses is critical to facilitating female enrollment in engineering majors.

This research illuminated seven key factors that positively influence young women's interest in and pursuit of engineering careers [8].

1. **Genuine Interest in and Positive Attitude towards Engineering**: Young women who are attracted to engineering often have a genuine interest in the field and view engineers and their work with high regard, recognizing its significance and impact on society.

2. **Value the Field of Engineering**: They understand that engineers address critical global challenges and believe that becoming an engineer will enable them to make meaningful contributions to society and improve the lives of others.

3. **Engineering-Related Self-Confidence**: Confidence in their ability to acquire the necessary skills and knowledge to succeed in engineering is essential for young women.

4. **Embrace a STEM Identity**: Identifying as an engineer or aspiring engineer and feeling a strong connection to the profession's values - feeling that engineering is an integral part of who they are - is a powerful motivator.

5. **Robust Support System**: Having a network of family, friends, peers, or mentors who encourage their aspirations and provide guidance is vital for young women pursuing engineering.

6. **Personal and Cultural Resilience**: Drawing strength from personal or cultural experiences, particularly in overcoming obstacles, can fuel their passion and determination to succeed in engineering.

7. **Sense of Belonging within the Engineering Community**: Feeling connected to a larger community of engineers or engineering students fosters a sense of inclusion and motivation to grow within the field.

The Role of Student Organizations: The Case of SWE at OSU

Student organizations play a crucial role in supporting these motivational factors through intentional programming and activities. The SWE student chapter at OSU serves as a compelling example.

Three years ago, the SWE chapter at OSU revamped its approach to programming to better support its members' diverse needs and interests. The chapter recognized the importance of creating a holistic environment that not only fosters academic and professional growth but also nurtures personal development and a sense of belonging.

SWE's Approach to Programming

In the time period post-COVID, the student chapter experienced a drop in membership and meeting attendance. The executive team decided to overhaul the programming, as they saw the need for more informal, community-building events. Prior to and during COVID, two meetings per month were held, and the majority of the programming included speakers from industry. The executive team decided to update the meeting content and move to one professionally oriented meeting a month and the second meeting focused on community building. This was possible due to the formation of a nine-person leadership team, consisting of the previous executive positions like president, vice president, secretary, and treasurer, but also an events coordinator, philanthropic events coordinator, media coordinator, mentorship chair, and an engineering student council representative.

SWE's new approach to programming encompassed the seven motivational factors mentioned previously. The chapter's leadership team carefully planned activities and events to ensure that members were provided with opportunities to develop their interests, build confidence, and connect with other women in engineering. This strategic approach to programming ensures that SWE caters to the diverse needs of its members and provides them with a supportive and empowering environment.

Examples of SWE's Programming and Activities

In this section, examples of programming and activities that the SWE chapter implemented to support each motivational factor are explained. In addition, the impact of the specific programming is discussed.

1. Interest in and Positive Attitude towards Engineering

SWE invited female speakers from various engineering companies to share their experiences and insights with the students. At these meetings, members asked questions about internship and fulltime opportunities, as well as the kind of daily responsibilities engineers at those kinds of companies had. Often, students would ask about leadership tracks within the companies and what that experience looked like for female engineers. Members also had the opportunity to talk with the company representatives one-on-one for a few minutes at the end of each meeting.

Many speakers who came to present at SWE meetings were also sponsors of SWE. Each year, the SWE vice president is tasked with recruiting representatives from companies that hire a variety of engineering disciplines to speak at meetings, as well as soliciting donations to fund the organization for the year. Starting in Fall 2023, the vice president contacted a larger list of companies and obtained 15 sponsors for both 2023 and 2024. These companies sent female engineers to speak to SWE members and give presentations about their company. Their companies would often also pay for dinner for the members at the meetings.

Impact: These speakers provided real-world perspectives on the challenges and rewards of an engineering career, inspiring the students to pursue their passions. By showcasing successful women in various engineering fields, SWE fostered a positive attitude towards women entering and succeeding in the profession and encouraged students to explore engineering career paths.

2. Value the Field of Engineering

Every fall, the University's College of Engineering Student Council hosts a Career Fair for their students. In 2024, 253 companies attended. To prepare SWE members for the fair, the SWE student section hosted a career fair panel for SWE members featuring representatives from numerous engineering firms. 13 female panelists participated in this event. By having a spectrum of companies presented, members are exposed to the diverse career paths available to engineers.

Panelists spoke about their educational backgrounds and their work experience. Students engaged directly with the panelists, asking them questions about activities they did in college to help them succeed, how to deal with gender discrimination in the workplace, and whether they felt it is more important to intern with the same company or explore different industries.

The majority of panelists were sent from companies who sponsor the SWE chapter. In most cases, if the company had a university or SWE alumni, the company would make sure to send her to the event. Although this is the only main career preparation event the SWE chapter did this year, they are also planning to host a resume workshop next year, in addition to the panel.

SWE also went on one engineering facility field trip in Fall 2023. Students visited a large Aerospace company to learn about the aerospace industry and career opportunities. Members toured the facility and examined a flight test plane. In Fall 2024, students visited another aerospace company, which was an airplane parts manufacturer. .

Impact: These events allowed students to explore different career options and understand the impact engineers can have on society. Additionally, it gave members insights into the day-to-day activities of engineers, and some of the challenges and opportunities women have in careers in industry, both personally and professionally.

3. Engineering-Related Self-Confidence

SWE organized STEM outreach activities with female students at the local Middle School, empowering the young women to engage with STEM fields and develop their self-confidence. By interacting with younger students, SWE members served as role models and mentors, encouraging them to explore their interests in STEM.

When SWE went to visit a Middle School during the 2023/2024 school year, members presented about the different engineering disciplines and taught the middle schoolers about different engineering career options/industries they could pursue in the future. They also conducted a STEM activity, where student teams competed to build the sturdiest bridge using limited supplies and learned about real-world engineering applications.

SWE also did outreach with the NASA Space Grant Consortium in their state and had a booth at their Girls in Engineering event in the spring of 2024. The objective of the event was to introduce middle school and junior high girls to the opportunities and possibilities within the engineering field, and to foster a love for innovation and problem-solving. SWE talked about their club and led an activity about electricity, helping students build their own electromagnets to demonstrate Lenz's law.

SWE officers also attended training session to learn important leadership skills such as conflict resolution and how to present in front of large audiences, which are transferrable skills to any engineering field. Officers also learned how to document procedures, from elections to membership tracking in order to prepare future executive teams for success.

Impact: Engineering outreach activities not only benefited the middle school students but also boosted the self-confidence of SWE members by allowing them to share their knowledge and passion for engineering.

4. Embrace a STEM Identity

The student SWE chapter held a leadership workshop in collaboration with a nearby metropolitan area's SWE Professional Chapter, providing opportunities for the students to develop their leadership skills and embrace their STEM identity. This workshop equipped students with the skills and confidence to take on leadership roles within SWE and in their future careers. At this workshop, students learned about how to deal with conflict, how to advocate for oneself as a female in male-dominated fields, and about skills that are important for success in the workplace, such as soft interpersonal skills and presentation skills. The leadership workshop also focused on ways to get involved with SWE and women-focused groups post-graduation.

Additionally, in Spring 2024, SWE hosted a public speaking workshop to help members develop speech skills, which are important for success in school and in industry. A faculty member who is director of the Leadership Institute at OSU, led an interactive workshop, inviting members to reflect on characteristics they admired in their favorite public speakers, giving tips on how to emulate them, and ways to deal with nervousness. He also had members (who were willing) practice saying a short unplanned speech in front of the group and offered critiques.

Impact: By fostering leadership skills and promoting a strong STEM identity, SWE empowered its members to become leaders and advocates for women in engineering.

5. Robust Support System

SWE implemented a Big/Little program, a mentorship program with coordinated events, in Fall 2024 to foster a strong support network among the members. This program paired a younger member with an older member, providing them with guidance and support as they navigated their academic and personal journeys.

At the beginning of the semester, SWE hosted a fun introductory Big/Little event so that the pairs could become acquainted with one another. At that meeting, pairs could paint matching tote bags together, make bracelets, or color.

After that initial meeting, pairs met with each other and developed relationships. The Big/Little coordinator would send out monthly challenges that pairs were encouraged to participate in together, including activities such as volunteering at the local animal shelter, exercising/doing yoga or walking around campus, and a “Sweet Treat” challenge that consisted of eating ice cream.

Impact: The Big/Little program created a sense of community and belonging, ensuring that every member had a support system within SWE.

6. Personal and Cultural Resilience

SWE partnered with the College of Engineering’s Diversity and Inclusion office during Women's History Month to celebrate women's achievements in engineering and promote cultural resilience. This event highlighted the contributions of women in engineering and inspired students to overcome challenges and persevere in their pursuits.

Another social event SWE hosted was a dance formal during both the 2023/2024 and 2024/2025 academic years. It was a large event that the officer team decided to offer as a way for members to celebrate the end of the spring semester and engage with other members. Additionally, an inspirational female guest speaker featured a College of Engineering Hall of Fame inductee who studied mechanical engineering at the university. She talked about her experience as a female in engineering and her work with the Cherokee Nation in promoting STEM by advocating for educational opportunities, particularly for Native American women.

Impact: By showcasing the resilience and achievements of women in engineering, SWE encouraged its members to draw strength from their personal and cultural experiences.

7. Sense of Belonging within the Engineering Community

SWE organized several social events, including making fresh flower bouquets, "Find a Friend" bingo, coffee and study nights, pumpkin painting, movie nights, gingerbread house making, and a "Relax with SWE - Canes and Coloring" event, to foster a sense of community and belonging among the members. SWE also provided dinner at all their meetings, catering from local restaurants.

The student SWE chapter also maintains active social media accounts, mainly Instagram and a Linktree, a website that many student organizations use to assemble links to various documents,

websites, and forms in one place. The chapter advertises all its events and posts member of the month features on Instagram.

In Fall 2024, the SWE chapter created a digital newsletter sent to members and company sponsors biweekly. It summarizes the meetings, shares photos, and communicates important information about scholarships, company sponsors, internship opportunities, and upcoming events.

Impact: These social events provided opportunities for students to connect with each other, build friendships, and create a supportive network. Additionally, the social media accounts and newsletter provide a platform for inclusive and inspirational messages on a regular basis. By creating a fun, inclusive and relaxed atmosphere, SWE fostered a sense of belonging and camaraderie among its members.

Meeting Attendance

Since 2022, the SWE Student Chapter has tracked attendance for each meeting held throughout the year. Analysis of this data provides interesting insights into the impact of the intentional programming in SWE and its impact on attendance. SWE meetings are held twice a month on Wednesday evenings at 7 pm on the campus.

Figure 1 depicts the number of attendees for the first kick-off meeting each year. This meeting is typically held in the second week of school, right after the executive board advertises the event at student organization fairs during the first week of classes. The first meeting of the year introduces attendees to SWE and gives the officers a chance to explain their mission for the year, including going over the calendar of events, upcoming volunteer and scholarship opportunities, and ways to participate in the reward system by earning points for extra involvement within the organization.

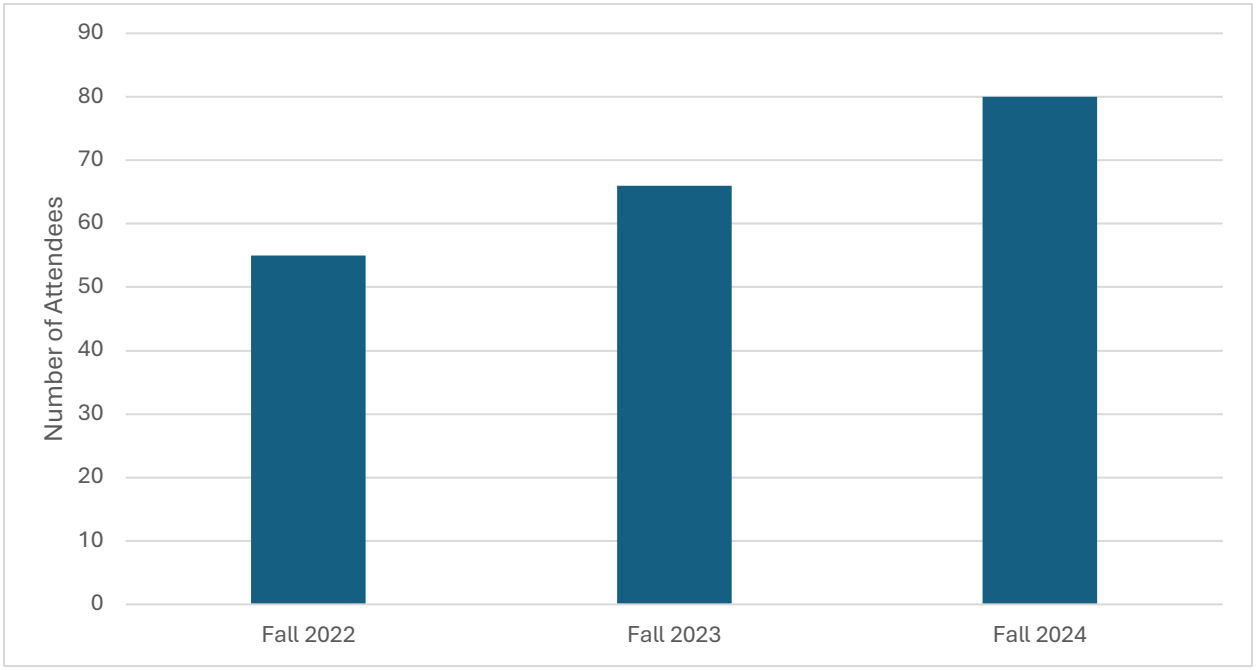

Figure 1. SWE meeting attendance for the first meeting of each school year

There was a 48% increase in first meeting attendance from Fall 2022 – Fall 2024. To promote the first meeting, the SWE officer team went to university-wide club recruiting events to help advertise to freshmen, as well as recruiting events specific to the College of Engineering to help recruit upperclassmen. These events happened both in the weeks before the semester began and during the first week of classes.

For the Fall 2024 semester, the officer team created and passed out pamphlets that contained information about the events for the fall semester, contact information (GroupMe, email, and Instagram), and pictures of students at events from the previous year. Including updated photos seems to have helped establish the organization's credibility and active presence on OSU's campus. Also, the officer team passed out stickers and worked with the Engineering College's marketing team to display an informational flyer on TV screens around the student lounges, study areas, and hallways. This same flyer was displayed on an A-Frame sign next to a common campus walkway as well.

Figure 2 shows additional information on meeting attendance, in order to include our most recent numbers from Fall 2024.

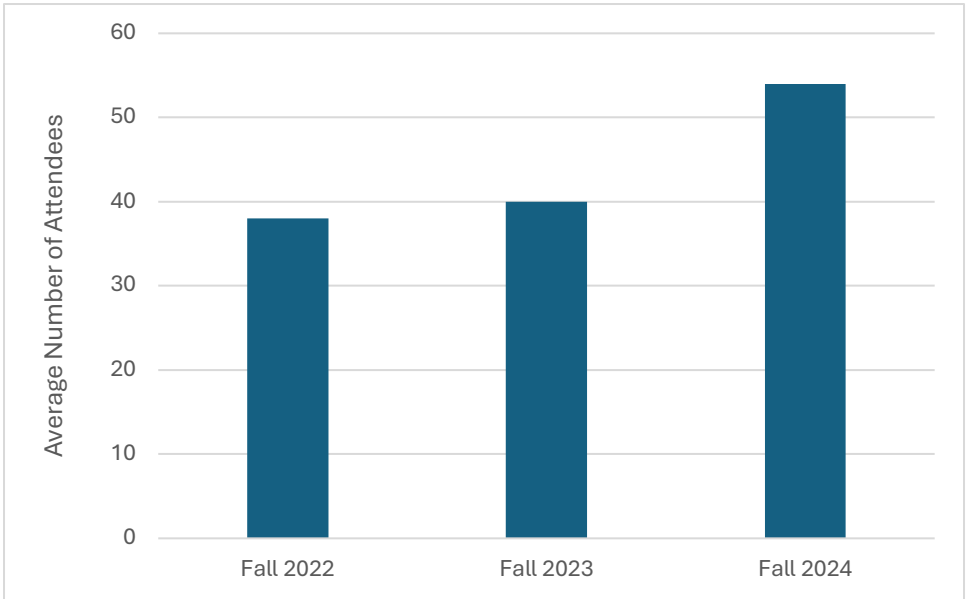

Figure 2. SWE average meeting attendance for fall semesters

From Fall 2022 to Fall 2024 the organization realized a 42% increase in average attendance. The chapter also encouraged more student participation by reworking the point system implemented in the Fall 2023 semester – the more points students earned, the more chances they had to earn prizes and rewards. The t-shirt designs were opened to the organization at large, where students submitted designs and voted on their favorite.

Another way the officer team was able to encourage more student participation was by collaborating with other STEM organizations at the university to host a semester-long food drive competition. This helped promote friendly competition between different organizations across campus. SWE also planned two yearly engineering facility field trips for the 2024/2025 school year, one per semester, and allowed members to vote on food they wanted served at each meeting.

Data for three full academic years on attendance is shown in Table 1.

Table 1. Average Meeting Attendance for Academic Years

School Year (Fall and Spring)	Average Meeting Attendance	% Increase Over 22/23
2022/2023	29	
2023/2024	38	31%
2024/2025	45	55%

SWE's comprehensive programming efforts led to a 55% increase in meeting attendance during the 2024/2025 school year. This highlights the effectiveness of focused programming in the student organization to attract and retain young women in engineering. The chapter's success can

be attributed to its commitment to creating a welcoming and supportive environment where members feel valued and empowered.

SWE Student Section Member Feedback
Each month, the SWE chapter honors a member of the month. Students fill out an application for this award. One of the questions on the application is “What is your favorite thing about SWE?”

Below is a representative sample of responses gathered:

- "There is a community for me to rely on and the fun activities."
- "Connecting with other women in STEM."
- "My favorite thing about SWE is that the people I've met there want nothing more than to be in your corner. It makes you feel special when someone you haven't really talked to just comes up and gives you a boost of confidence!"
- "Honestly everyone is very welcoming and it's a very chill environment with food!!"
- "The community of strong women looking for genuine friendships. Being able to get involved in an organization that encourages women to support women."
- "Getting to hang out with my friends and meet women with similar interests!"
- "My favorite thing is the community and having the ability to engage in conversations with other engineering majors who I would have never been able to interact with during my college career."
- "I enjoy getting to meet with my friends and eat dinner, even when it's a busy week."
- "The sense of community I get being around women with the same drive to change the world."
- "It's an amazing opportunity to meet women with similar passions while being in a male-dominated field."
- "You get to hear so many inspiring people share their stories and how they got to their position."
- "My favorite thing about SWE is that although we are all busy with classes we take the opportunity to prioritize fellowship with other females in engineering and spend time taking a break or learning from our guest speaker together."

These comments further illustrate how SWE's programming fosters a sense of community, belonging, and support. SWE provides a space for women to connect, learn from each other, and build lasting relationships.

Conclusion
The experiences of the SWE student chapter at OSU demonstrate the vital role student organizations play in supporting and empowering young women in engineering. Through intentional programming and activities aligned with the seven motivational factors, SWE has successfully created a more inclusive and supportive environment for its members, leading to increased engagement and a sense of belonging.

The SWE chapter's success can be attributed to several key factors:

- **Aligning programming with motivational factors**: By focusing on the seven motivational factors, SWE ensures its activities cater to the diverse needs of its members.

- **Creating a supportive community**: SWE provides a space for women to connect, support each other, and build lasting relationships.
- **Providing opportunities for personal and professional growth**: SWE offers programs and activities that help members develop their skills, confidence, and leadership abilities.
- **Promoting a sense of belonging**: SWE fosters a welcoming and inclusive environment where all members feel valued and respected.

These results emphasize the importance of continuing research into the motivational factors for young women in engineering and sharing best practices among student organizations and educational institutions. By fostering a culture that values diversity and inclusivity, more young women can be encouraged to pursue their dreams of becoming engineers and contribute to a more innovative and equitable future.

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