Pioneering a Society for Women in Mechanical Engineering Student Organization

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Abstract

This full practice paper discusses the creation of the Society for Women in Mechanical Engineering (SWME) at a large, land-grant university, including preliminary findings from its first year of operation. This paper responds to a longstanding need to recruit and retain more women in engineering and focuses on an engineering discipline with one of the lowest representations of women – mechanical engineering. In 2022, ASEE by the Numbers reported that only 17.6% of Mechanical Engineering Bachelor's Degrees were earned by women. At the university where SWME was launched, the percentage of Mechanical Engineering Bachelor's Degrees earned by women is even lower, at just 12%. The author team, which includes both undergraduate students and faculty in the mechanical engineering department at the university, found through prior research and personal experiences that students in the mechanical engineering department lacked both a strong sense of community and peer support networks. In response to the underrepresentation of women in the department and the lack of community, the author team created and launched the Society for Women in Mechanical Engineering. SWME is a student-driven and faculty-supported organization that aims to create community and foster peer mentoring. This paper argues for the need for SWME, anchoring in existing literature and detailing how the mission of SWME differs from the mission of the Society of Women Engineers. Moreover, this paper discusses how SWME is organized, including the executive council roles, events, and ethos behind the structure. Lastly, this paper presents preliminary data from the first year of SWME, including both quantitative attendance and retention counts and qualitative focus group data. The authors intend for this paper to enable others at different universities to create their own chapters of SWME and to spark conversation about the need for discipline-specific organizations to support women in engineering within universities.

Introduction

In recent years, the need to recruit and retain more women in engineering has become increasingly apparent [1]. Women bring diverse perspectives and innovative solutions to the field that are essential for advancing engineering as a whole [1]. Despite this need, specific disciplines, such as mechanical engineering, continue to struggle with low representation of women. In 2022, mechanical engineering was the discipline with the greatest number of bachelor's degrees awarded to graduates at 32,891; only 17.6% of those were awarded to women [2]. Recognizing this existing disparity as well as the future demand for mechanical engineers, organizations like the American Society of Mechanical Engineers have encouraged the creation of supportive initiatives aimed at bolstering the participation of women in mechanical engineering [3]. These initiatives are designed to foster a sense of community, providing students with robust support networks and access to mentorship. Research consistently highlights the positive effects of mentorship on student success, reinforcing the idea that professional societies play a crucial role in empowering their members. The Society of Women Engineers (SWE) serves as a broad-reaching organization that encompasses all engineering disciplines, promoting camaraderie among women engineers. While SWE offers valuable connections and resources, its wide-ranging focus can limit the depth of support provided to members within specific fields, presenting a unique opportunity for the creation SWME. By concentrating on the needs and

challenges faced by women in a specific discipline, the club can offer tailored mentorship, resources, and community-building initiatives that address the unique barriers women encounter in mechanical engineering. Currently, there are few dedicated programs to support women in this area, with notable examples limited to Stanford's doctoral and graduate programs [4] and the University of Wisconsin-Madison's undergraduate initiative [5]. However, research on the implementation and effectiveness of these programs remains sparse, highlighting a critical gap in support that SWME aims to fill. Through this initiative, we can create a vibrant community that champions the success of women in mechanical engineering and ultimately contributes to a more equitable and innovative engineering landscape. Accordingly, the purpose of this paper is to argue for the importance of starting a club for women in mechanical engineering and provide an example of how one was implemented within one university.

Literature Review

History of Women in Engineering

Women have historically been underrepresented in engineering and other technical fields. The origins of this phenomena come from the 19th century when men were granted the status of 'engineer' through their time spent on sites that typically excluded women rather than through an education process [6]. Additionally, women who pursued scientific interests outside of the domestic sphere were often regarded as unconventional and engaging in inappropriate activities for respectable women of the time. Despite these social constraints, a small number of women ventured into the field of engineering by attending land-grant universities in the early 20th century. However, even during World War I, women in engineering were often viewed as intruders in the field. A significant shift occurred during World War II, when large segments of the male workforce were enlisted to serve overseas. This shift resulted in labor shortages in factories and companies, creating a demand for workers [7]. In response, companies such as the Curtiss-Wright Airplane Company and General Electric partnered with universities to offer accelerated educational programs aimed at quickly training women to fill these gaps [6]. Following the conclusion of World War II, much of the progress made in integrating women into engineering was reversed. However, many women retained their interest in engineering, and some universities persisted in having women enrolled in engineering and science unrelated to the domestic sphere. Since then, specifically after 1970, programs have been implemented to retain and grow the presence of women in engineering [8].

Initiatives to Improve Representation of Women in Engineering

Federal funding and policy have significantly influenced the emergence and development of programs aimed at building a diverse STEM workforce, historically improving the representation of women in engineering. These policies were driven by a combination of social, economic, and political factors. A pivotal moment came in 1950, when President Truman signed the National Science Foundation (NSF) into law, which provided a centralized department to coordinate and expand the fragmented efforts and investments in science at the time [9]. In the following decades, the feminist and civil rights movements played a crucial role in advocating for policies to address inequities in STEM fields. One notable outcome was the passage of the Science and Technology Equal Opportunities Act of 1980, which aimed to increase access and opportunities

for women and minorities in these fields [10]. Many programs today focus on the retention and advancement of women in engineering, but these efforts are often part of a broader goal to create a more equitable environment for marginalized groups as a whole [11]. However, recent policy changes and grant cancellations threaten these programs focusing on the retention and advancement of women in engineering [12], making sustained and targeted support for each group even more essential for ensuring meaningful and efficient advancement.

Innovative Practice

Purpose and Mission of SWME

The mission at the heart of SWME is to increase retention rates in the department of Mechanical and Materials Engineering at the home university. Overall, the goal of SWME is to build community for all mechanical engineering students. SWME is intended to be a place to form connections and find dedicated support while offering opportunities for students in specific areas of mechanical engineering, including consulting, aerospace, manufacturing, and even academia. Importantly, SWME is open to all students.

Because SWME is a discipline-based organization, it is not considered a sub-unit of SWE. This separation is intentional in order for SWME to have autonomy as a student organization and the ability to function in a way that best supports its members. While Mechanical and Materials Engineering is the largest department in the college of engineering, with 790 undergraduates, only 12% of those students are women. There is also a heavy emphasis on team-based projects within mechanical engineering specific courses. Having a group focused on helping women build community within mechanical engineering creates a network for students to establish connections with other students who are in or will be in their discipline-specific courses. This community building can also help members to form groups in courses that rely heavily on teamwork. For example, the capstone program is completed in the final year of engineering coursework, and many hours are spent with the team established at the beginning of the year. Knowing the peers that you work well with can be invaluable in this case. A partnership with SWE and ASME has also been built in order to leverage the resources of the groups and previously established connections to industry in the area.

Membership

All engineering students are eligible to be a member of SWME. There are currently 60 members, 44 of which are women studying mechanical engineering. Engaging everyone as supporters and advocates helps drive cultural change within engineering departments and workplaces. There are executive positions available in the club, which contribute to the professional and leadership skills that can be built through this involvement. Undergraduate and graduate students are welcome in order to build a larger and more comprehensive community.

Table 1. Membership Breakdown

Major		Gender			Level				
MME	Non-MME	F	M	Other	1	2	3	4	Gr
49	11	51	7	2	14	18	15	11	2

Table 1 depicts the breakdown of membership based on major (within or not within the Mechanical and Materials Engineering department), gender (female, male, or other), and grade level (1st, 2nd, 3rd, 4th year or graduate). For reference, the entire Mechanical and Materials Engineering department 790 undergraduate students with 101 female undergraduates. Membership has grown from 41 members in the first semester to 60 members in the second semester.

Executive Board and Structure

The executive team plays a vital role in the governance and continuation of the club. They are empowered to create officer positions or committees as needed, with any such changes requiring a simple majority vote from the membership. This flexibility allows for adaptation to the evolving needs of the club and its members. Being highly adaptable allows for the greatest impact to be made on the community. There were originally 10 executive positions when the club was created, but as time went on, it was discovered that this was inefficient. The total number of positions was decreased to six. Table 2 shows the executive roles and the responsibilities assigned to each respective position.

Table 2. Officer Titles and Main Responsibilities

Officer Title	**Main Responsibilities**
President	Oversee and delegate club operations Facilitate executive team meetings Oversee elections
Vice President of Membership	Assist President with aims of club Manage recruitment efforts
Vice President of Public Relations	Maintain social media accounts including Instagram and LinkedIn Maintain LinkTree Make and distribute flyers for events
Treasurer	Manage funds Organize fundraising efforts and find sponsors
Primary Programmer	Organize events Order food Reserve rooms Coordinate with Public Relations
Secretary	Manage email, calendar and directory Keep detailed records of executive meetings

Each of these positions was formed in order to target the respective goal of the club. The model was created from the authors' previous experiences in organizations and professional societies. Reflecting on what has been done well and what could have been improved in those previous involvements contributed to the creation of this refined executive board structure. By establishing these roles and norms, a strong foundation has been created for the club, setting the stage for effective governance and active member engagement as it grows and develops. With

these six positions, there are enough individual tasks to occupy each role and create a sense of worth, while also not entailing an overwhelming amount of work to keep up with as a student.

Community Building and Mentorship

Table 3 gives a summary of events from SWME's first year of operation. Events are planned by executive board members and aim to meet the needs of the membership body. For example, a study night was held the night before the first statics exam, a class which is known to be challenging for engineering students. There, upperclassmen and classmates were present to help with questions about the content and provide encouragement. Additionally, a senior panel was held when the course registration was happening, which allowed members to ask questions about which classes and professors they should select. Insight on how specific classes were structured provided the listening students with enough information to decide for themselves if a certain class or professor would be appropriate for them.

Mentorship within SWME was extended through an opt-in mentorship program where upperclassmen were paired with underclassmen. For the Fall 2024 semester, approximately 25% of members decided to become a mentor/mentee. Those who were junior, senior, or graduate level students were then invited to contact and connect with the freshmen and sophomores who wanted to participate. This system was intended to begin the process of one-on-one support and deepen connections within the club. Further mentorship investment is anticipated for future semesters.

Table 3. Events

Fall Semester Events	**Timeline**	**Attendance**
Welcome Social	September	45
Study Night	September	19
Senior Panel / Mentorship Night	October	14
Pumpkin Painting and Movie	October	29
Potluck	November	63
Destress Event	December	16
Spring Semester Events		
Welcome Social	February	34
Study Night	February	28
Lab Night	April	19
Jeopardy Night	April	22

In the future, SWME aims to offer targeted professional development opportunities such as resume workshops and career advice tailored to women in mechanical engineering as well as leadership training and opportunities within the club. These activities will help prepare members for successful careers in the field and address any gender-specific challenges they may face.

By creating a visible community of women in mechanical engineering, the club can inspire younger students and show that women belong in the field as well as challenge stereotypes about engineering. It can provide role models for aspiring women engineers as well. This increased

visibility can help attract more women to mechanical engineering and improve gender diversity in the long term.

SWME serves as a platform for raising awareness about gender-related issues in mechanical engineering and collaborating with faculty and administration to create a more inclusive environment. These efforts can contribute to positive cultural changes within engineering departments and the broader industry.

Data from First Year

The creation of a strong foundation for the club has been the main priority, but observations of participation and effects of group activities can still be taken. The quantitative attendance data collected shows that more socially centered events were more popular than professional development or course related topic activities. The Potluck event was unique in that it was a collaboration with the other mechanical engineering organizations on campus.

Verbal feedback was often given to the event coordinators and executive members after each event. One student shared that they "would feel lost without the guidance and reassuring attitude of the seniors." Another member said their favorite part was "connecting with other women in engineering and relating to their experiences". Attendance numbers will be recorded in the future as well as member impressions and feedback.

Future of SWME

SWME is committed to growing and evolving to better serve its members and the broader mechanical engineering community. The immediate goals for development are focused on expanding tutoring and mentoring programs, strengthening industry connections, and building a solid foundation for future growth. One of the primary objectives is to increase the involvement of upperclassmen in tutoring and mentoring roles. By fostering deeper relationships between upperclassmen and underclassmen, a supportive, collaborative environment is created that encourages both academic success and personal growth. Upperclassmen bring invaluable experience and knowledge that can guide underclassmen through the challenges of mechanical engineering coursework, providing a sense of camaraderie and support throughout their academic journey. The importance of furthering our connections with the industry, both locally and beyond, has been recognized. By engaging with industry professionals and organizations, we can offer our members access to mentorship opportunities, internships, and potential career pathways. One of the long-term goals is to establish industry mentors who can provide guidance, share insights into the field, and help students make informed decisions about their careers. These connections will not only benefit members but also strengthen ties to the broader mechanical engineering community. Additionally, building a strong relationship with the university and aligning our efforts with both existing and new programs that support the mechanical engineering discipline will be a key focus. SWME intends to collaborate with university departments, faculty, and other student organizations to ensure that the activities complement and enhance the academic experience for our members. With coordination and intentional decision-making, improvements are bound to come.

Conclusion

Addressing the gender gap in mechanical engineering is not only a necessary step toward equity but also a key factor in fostering a more innovative and dynamic workforce. A club dedicated to supporting women in mechanical engineering plays a vital role in overcoming the unique challenges faced by women in this field. Through targeted support, mentorship, and professional development opportunities, such initiatives are instrumental in attracting and retaining women in the discipline. As the field of mechanical engineering continues to evolve, creating spaces for all students, including women, to thrive and connect is crucial for growing a strong engineering workforce. Ultimately, these efforts will contribute to a stronger, more resilient engineering community that reflects a broad range of perspectives and talents, driving progress and innovation in the field.

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