Engineering Ambassadors Network (EAN): Goals, Successes, and Challenges in Growing the EAN

Ms. Christine Haas, Engineering Ambassadors Network

Christine Haas brings ten years of experience working in marketing and communications with a focus on the science and engineering fields. She’s held positions as the director of marketing for Drexel’s College of Engineering and director of operations for Worcester Polytechnic Institute - Engineering.

Now, as CEO of Christine Haas Consulting, LLC, Christine travels around the world teaching courses to scientists and engineers on presentations and technical writing. She has taught clients across government, industry and higher education, including Texas Instruments, Brookhaven National Laboratory, European Southern Observatory (Chile), Simula Research Laboratory (Norway) and the University of Illinois-Urbana Champaign. Christine works closely with Penn State University faculty Michael Alley (The Craft of Scientific Presentations and The Craft of Scientific Writing) and Melissa Marshall (TED, "Talk Nerdy to Me") on these courses.

Christine is also the director of the Engineering Ambassadors Network, a start-up organization at 25 plus universities worldwide that teaches presentation skills to undergraduate engineering students, particularly women and underrepresented groups in engineering. These Engineering Ambassadors develop valuable leadership and communication skills, which they apply through engineering outreach to middle and high school students.

Christine received her MBA in marketing and international business from Drexel University and her BA in English and film from Dickinson College.

Mr. Michael Alley, Pennsylvania State University - University Park

Michael Alley is an associate professor of engineering communication at Pennsylvania State University. He is the author of The Craft of Scientific Presentations (Springer-Verlag, 2013) and founder of the website Writing Guidelines for Engineering and Science (writing engr.psu.edu), which receives more than 1 million page downloads each year.

Dr. Joanna K. Garner, Old Dominion University

Dr. Garner is a Research Associate Professor in The Center for Educational Partnerships at Old Dominion University, VA.
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The engineering field is facing a crisis. In order to solve today’s engineering challenges, we need a diverse workforce with strong technical and leadership skills. Unfortunately, workforce studies have shown that the number of students being educated in STEM (science, technology, engineering, and math) cannot meet projected demands.\(^1\) In addition, current enrollments in engineering are not diverse, with incremental movement in the number of women, blacks, Hispanics and Asians enrolling in engineering from 2001 - 2011.\(^2\) Finally, studies have shown that better leadership and communication skills are needed among the current engineering workforce.\(^3\)

The Engineering Ambassadors Network (EAN) is a collaboration of more than 30 universities and colleges with Engineering Ambassadors programs unified in their goal to address these problems facing the engineering profession. Each Engineering Ambassador program (1) trains undergraduate engineering students as Engineering Ambassadors (EA) to share their passion for engineering using exceptional communication and presentation skills (2) cultivates a diverse set of Engineering Ambassadors to provide role models for future generations and encourage a representative workforce and (3) connects the Engineering Ambassadors with a diverse group of middle and high school students to show them the possibilities within engineering. The Engineering Ambassadors Network helps to support and unify these programs by offering training opportunities, creating platforms for continued communication among the schools, leveraging resources among the members, and raising visibility for this important cause.

The EAN has had successful impact, both in terms of outreach numbers and the impact of the program on the Engineering Ambassadors themselves. Some of these successes are detailed in a companion paper “From Undergraduates to Ambassadors: The Impact of the EA Network Training,”\(^4\) which details assessment on the effects of the network on Engineering Ambassadors. However, there are challenges in growing this collaboration national and internationally. We are uniting a community of busy people virtually, while also trying to maintain our unique culture, and learning much in the process. In this paper, we explore the successes and challenges of creating a thriving Engineering Ambassadors community.

This paper will first give background information on the Engineering Ambassadors Network and Engineering Ambassadors programs. Next, this paper will give an overview of the Engineering Ambassadors’ training and the impact of this training on the Ambassadors. Finally, this paper will summarize successes and challenges in developing the Engineering Ambassadors Network.

About the Engineering Ambassadors Network

After a successful collaboration between Penn State University, Rensselaer Polytechnic Institute (RPI), University of Connecticut, and Worcester Polytechnic Institute, the Engineering Ambassadors Network expanded to more than 20 universities in August 2012. Engineering Ambassadors programs now exist at over 30 universities around the world, and these programs
collaborate and leverage resources under a grant from the National Science Foundation. See Figure 1 for a map of the member universities’ locations across the United States.

**Figure 1:** A map of EAN members in the United States

As Figure 1 shows, a large number of programs exist in the Northeast, due to the collaboration that started here with the first four schools. However, we are spreading across the country, using regional workshops as our vehicle to bring in new members, discussed further in the section “Training the Engineering Ambassadors.”

Members of the Engineering Ambassadors Network have common trademarks that unify the programs. These are trademarks they agree to uphold as they join the Engineering Ambassadors Network:

1. **EA programs support a diverse group of Ambassadors:** Programs support activities of a critical mass of diverse students, with a focus on women and underrepresented students of color from a range of engineering majors.
2. **The ambassadors in the program are communication virtuosos (or well on their way):** The professional development of the Ambassadors, especially in communication, is a core mission of each program. The Ambassadors learn these skills through academic training, whether it’s a credit-bearing class or an extended workshop.
3. **The ambassadors connect students to engineering:** Outreach to middle and high school students is a core tenet of the program. They use messages from NAE’s *Changing the Conversation* to ensure their message resonates with these students.
(4) **The program participates in the Network:** They attend trainings held by the Network, they share resources with other schools, and use the online learning tools provided by the network.

(5) **The program has a faculty or staff advisor:** These programs are driven by an enthusiastic advisor, though they often have a student leadership team that also helps the advisor.

The communication trademark is significant to the Engineering Ambassadors Network. At EAN trainings, we teach the Engineering Ambassadors advanced presentation styles, and this becomes a skillset that significantly contributes to their identity as an Engineering Ambassador. Garner et al. explain “Students perceive that the training provides an opportunity to gain technical communication skills and the confidence to be able to fulfill the mission of the EA network, which is to deliver outreach presentations to middle and high school students.” Therefore, making this specialized training available to all EA members is a crucial objective.

In addition, the networking at these trainings helps the Engineering Ambassadors see themselves as part of a larger mission and community. Continued communication between schools, therefore, is important to make the ambassadors and advisors feel part of a larger whole. While there are some communication tools we use that help facilitate this, we continue to explore better virtual platforms to help members across universities connect.

Having a diverse set of Engineering Ambassadors is also an important component of EAN member programs. The diversity within the Engineering Ambassadors helps diversify the engineering field by addressing two areas of the pipeline: the ambassadors and the students they reach. By focusing on recruiting a diverse set of Engineering Ambassadors and training them, we give a voice to underrepresented groups in engineering. By providing examples of near-peer role models in the field, we hope to show K-12 students that engineering is for everyone and inspire them to consider engineering as a potential career option.

A survey is sent annually to all advisors of EAN member programs, and was last sent in August 2015. The survey was completed by about half the member universities. According to the responses from this EAN survey, there are nearly 500 active Engineering Ambassadors within these programs. Just over half of these ambassadors are women, and one-third are Asian, African American, Hispanic, or another ethnicity. From July 1, 2014 to June 30, 2015, this group reached nearly 26,000 students and just over 64,500 total people (including parents of students and other members of the general public). Because of our mission and the expansive reach, we would like to further increase our diversity. While we can encourage diversity in the programs, the network is not responsible for hiring the Engineering Ambassadors. The programs operate independently and hire the Engineering Ambassadors.

**About Engineering Ambassadors Programs**

While the EAN raises visibility for programs and leverages resources, each program operates on its own. This flexibility allows member universities to create a program that will fit within the unique framework of their home institution, meet needs of the university, and allow the program to adapt as it grows. Some common elements exist across universities, but there are
also some variations in program structure.

One of the most notable variations is the size of programs, which range from seven to 95 ambassadors depending on the university. The program is also housed in different departments or colleges, depending on the university structure. Often the college of engineering will be the “home” for the Engineering Ambassadors, but in some cases the outreach office or even admissions office runs the program with input from the engineering college. These programs are then supported by the corresponding office, or from external sponsorship. While most programs run a competitive application process to hire their Engineering Ambassadors, each program sets their standards for entry. Depending on the program, some Ambassadors are paid a stipend for their work, while other programs run a volunteer model.

The way outreach is conducted varies across programs. Some programs travel to the schools to give presentations and run hands-on activities. Others have the middle school and high school students come to their campus. In addition, some Engineering Ambassadors work in after-school programs with the students, or volunteer at large campus events that occur during celebrations like National Engineers Week. The strongest Engineering Ambassadors programs are essential to multiple departments across the university. Therefore, many Engineering Ambassadors programs also present to prospective students, parents, grade school students, potential donors, industry partners, and many other audiences.

More important than these structural variations, however, is the advisor who runs the Engineering Ambassadors program. Because the advisor has such a significant role, they shape much of the program and its impact. The advisor runs the day-to-day of the program, including but not limited to: managing the schedule and program for outreach, supervising the ambassadors presentation and hands-on activity development and execution, holding regular meetings with the ambassadors, facilitating internships from corporate partners, facilitating training for the Ambassadors, recruiting Ambassadors to the program, assessing the progress and impact of the program, finding program sponsorship, and creating a community among the program participants. The advisor is often a staff or faculty member, with only a portion of their time allotted to running the Engineering Ambassadors program. Some programs have more than one advisor, but all have at least one faculty or staff advisor.

Since the advisor is largely responsible for training or bringing in external instructors to train the Engineering Ambassadors, how training is conducted varies across institutions. While many ambassadors attend an Engineering Ambassadors Network training event, supplemental training is at the discretion of the university. Therefore, the EAN onsite trainings, as well as the online training modules, become an important piece for unifying the culture and community across the EAN.

Training the Engineering Ambassadors

The hallmark of the Engineering Ambassadors Network is a two and a half-day training workshop to help prepare new Engineering Ambassadors to give outreach presentations to middle and high school students. For these workshops, participants are paired in teams of two, as Engineering Ambassadors almost always present in pairs. These teams are given a preparation
assignment to select a presentation topic, which they submit ahead of the workshop to receive feedback from the instructor. Engineering Ambassadors are instructed to select a cool or unusual engineering topic that highlights messages from *Changing the Conversation*, like “Engineers are creative problem solvers,” or “Engineering is essential to our health, happiness, and safety.”

The ambassadors come to the workshop with a topic selected and some collateral (pictures, research, etc.) to begin their presentation. Over the course of two days, they develop, practice and deliver an engaging 10 to 15-minute outreach presentation. When the ambassadors give these presentations in live classrooms, the presentations are often accompanied by a hands-on activity. However, due to the length of the workshop, the training focuses on building the presentations.

During the first day of the workshop, Engineering Ambassadors are taught about presentation content and visuals. The visuals module focuses on an advanced presentation strategy called assertion-evidence. Assertion-evidence encourages presenters to give talks based on messages, rather than phrase headlines or bullet points. In assertion-evidence, the presenter has a single complete sentence at the top of the slide (the main message of the slide) with visual evidence supporting the message. Our research has found that audiences of STEM presentations have a deeper understanding and better recall when the presenter follows the assertion-evidence approach as opposed to the common practice of having a phrase headline supported by a bulleted list.  

On the second day of the workshop, ambassadors have a short module about how to deliver a presentation and give feedback. Then, the students give a draft of their presentation and receive feedback in small group critique sessions. They have time to revise their presentation, and then go through a second critique session. While the turnaround from learning to application is quite short, the critique sessions are instrumental to progressing from a draft presentation to a polished presentation. On the last day of the workshop, the Engineering Ambassadors showcase their work in a conference-style showcase session. Some of the presentations to come from these workshops can be seen in Figure 2. For most ambassadors, the workshop gives them an example of how to build presentations. They will go on to build additional presentations for outreach, share their college experience with prospective students, or apply techniques they learn in their academic and professional presentations.

**Figure 2:** Title slides of presentations from Engineering Ambassador training workshops
This training is hosted by universities across the country, and is led by one or two EAN instructors and two or more seasoned Engineering Ambassadors. While trainings are occasionally held for a single program, we are moving towards a regional workshop model. In the regional model, neighboring universities are invited to attend so the ambassadors and advisors train together. One advantage of the regional workshops is the economies of scale, as cost increases are minimal, despite the additional attendees. Other advantages include collaboration and networking opportunities. The largest regional workshop we’ve held to date was at Worcester Polytechnic Institute in the fall of 2015. This workshop was attended by nine universities and 170 participants (149 ambassadors). On the post-workshop evaluation form, participants listed the critique sessions and the networking, two areas that improve with increased attendees, among the top five best aspects of the workshop.

Since this training brings such positive impact, we would like to bring this to as many Engineering Ambassadors as possible. When a university hosts the training, nearly all of their ambassadors usually attend. However, if a university is traveling to attend a workshop, they may only bring a portion of their ambassadors. We have developed some online resources to help spread the basics of this training. However, we need to do a better job of promoting these and ensuring all members use these as core tools, in order to further unify our programs.

Another challenge we have is the time frame of the trainings. The workshops typically begin on Friday morning and end Sunday after lunch. The lectures take place on Friday, critique sessions on Saturday, and the showcase on Sunday morning. Two and a half days is tight, but manageable, to complete this process. However, many students have a hard time devoting two and a half days to the training, especially when it involves missing classes on Friday. While we’ve tested shorter time frames, the resulting ambassador presentations are not as strong. Two nights to work on the presentation, with the showcase on the final day, yields the strongest presentations. The balance between a successful workshop schedule and the ambassadors’ schedules is a challenge we face every year, and we have renewed our marketing efforts to better show the value of this training. For example, we use quotes of workshop participants who have taken the training. Initial assessment results suggest the training is worth the challenges, as it has a transformational effect on the Engineering Ambassadors.
Assessing the Training on the Engineering Ambassadors

Since the start of the NSF grant in 2013, we’ve held three to four workshops per year, with 2015 as the first year with all regional workshops. See Table 1 for the locations and attendance numbers of these workshops. The table shows that our workshop at WPI was by far the largest. We’ve held a workshop in the Northeast at one of our four founding member’s universities for five consecutive years, so attending the workshop has become a prerequisite for ambassadors within the programs that attend. In addition, many of our members are within easy travel distance to this workshop.

Table 1. Attendance for the 2015 Engineering Ambassadors Network trainings held in the U.S.

<table>
<thead>
<tr>
<th>Host University</th>
<th>Date</th>
<th>Attending Universities</th>
<th>New EAs Trained</th>
<th>New EAs Underrepresented in Engineering (%)</th>
<th>Total Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNL</td>
<td>Jan.</td>
<td>Vanderbilt</td>
<td>24</td>
<td>Unknown</td>
<td>30</td>
</tr>
<tr>
<td>Ohio University</td>
<td>Sept.</td>
<td>West Virginia University, Ohio State University</td>
<td>20</td>
<td>85%</td>
<td>24</td>
</tr>
<tr>
<td>UNL</td>
<td>Oct.</td>
<td>Wichita State University</td>
<td>24</td>
<td>58%</td>
<td>33</td>
</tr>
<tr>
<td>WPI</td>
<td>Oct.</td>
<td>RPI, UConn, PSU, UMaine, Tufts, Union, JMU, Geneva</td>
<td>98</td>
<td>72%</td>
<td>170 (51 Senior EAs) (21 Advisors)</td>
</tr>
</tbody>
</table>

The assessment on the Engineering Ambassadors Network focuses on documenting the impact of these workshops on the ambassadors themselves. This assessment has been done through post-workshop evaluation surveys, as well as interviews with the ambassadors and the advisors. Post-workshop surveys and interviews have revealed that the workshop is a transformative experience, resulting in increased confidence and benefits that affect the Engineering Ambassadors personally and professionally. “From Undergraduates to Ambassadors: The Impact of the EA Network Training” explains the impact of the workshop on the participants in more detail, so we will not explain the assessment in further detail here.

Developing Online Tools for Engineering Ambassadors Network Members

Given the success of the workshops, we’d like to maintain the same energy and cross-network communication throughout the Engineering Ambassadors’ entire program experience. We’ve developed and tested some online platforms to help keep the conversation and collaboration going, as well as continue the training. Besides social media like Facebook and LinkedIn, we’re testing Slack, an online communication program, as a means of maintaining dialogue between the schools. Keeping the conversation going between schools can be
challenging. Advisors and students are busy. Also, new schools coming into the group may not feel as comfortable joining in conversations on social media as schools who have been interacting since the beginning of the EAN.

We have a shared library of presentations and hands-on activities that can be accessed by Network members. We are also developing tools used by each member for program operations. The challenge comes from creating resources fast enough that can cover the expanse of program in the network. Because each program is at a different stage in development, the advisors and Engineering Ambassadors have differing needs. In addition, creating resources that are a “one size fits all” approach is difficult, since each program operates differently. For example, one university had the idea to share a progress report – essentially a job evaluation – with ambassadors at the end of each semester. However, creating a progress template that can be shared across universities is challenging, since participation requirements and expectations varies across programs.

We’ve also created and posted online learning modules on the Engineering Ambassadors Network website for Engineering Ambassadors and advisors to refresh their communication skills, and provide some consistency in training. These online modules have been developed for content, structure, visuals and delivery. The modules include several videos and short quizzes after each video, to help the audience determine if they have internalized the main principles from the lesson. You can see an example of these modules in Figure 3.

Figure 3. Screen capture from online training module for EAN on content: https://www.softchalkcloud.com/lesson/serve/943yau7Bztb8dA/html
Successes and Challenges of the Engineering Ambassadors Network

The Engineering Ambassadors Network is successfully growing at a steady rate, with three to four new schools joining each year. The level and quality of outreach from these programs remains high, based on progress of those Engineering Ambassadors returning to the workshops and reporting from the advisors. In addition, the different program models at each institution has allowed the programs to develop and adapt to their institution, while also maintaining the core values of the Engineering Ambassadors Network.

Another successful outcome has been the training for the Engineering Ambassadors. The two and a half-day workshop has had an impact on the Engineering Ambassadors, with participants reporting an increased level of confidence in their communication skills. We have also had success in bringing new schools into regional workshops, rather than having new schools host their own workshop. Bringing new schools into regional workshops allows them to have immediate interaction with more seasoned programs and see examples of thriving programs.

Finally, the level of outreach from the members is impressive. Member schools reported reaching just over 64,500 people in academic year 2014-15, and these survey results account for only half of the member institutions. Members’ enthusiasm for outreach is high, with Facebook posts on outreach activities accounting for one of the most common “announcements” on the Engineering Ambassadors Network’s social media.

While we hold workshops in various locations across the country, building attendance and establishing the culture for these workshops is hard at first. We need to find better ways to convince students who have not heard of the training to dedicate time to attending the training, especially given the hesitation to devote two and a half days to the training. We will expand our marketing efforts, perhaps creating a short video advertisement to convey the benefits of the training. We will also continue to expand our online modules to reach more Engineering Ambassadors.

In addition, the training can’t end once the students leave the workshop. We have a large contingent of seasoned Engineering Ambassadors, who need advanced training beyond what we provide at the workshop. We have started to address this by testing advanced training sessions for seasoned ambassadors at the workshop. We plan to continue refining this and creating online modules to carry students beyond the workshop.

Continuing collaboration and conversations among members after the workshop can also be challenging. The advisors and the Engineering Ambassadors are extremely busy and focused on their program operations. Finding more ways for cross-university collaboration is an important goal for the coming year. There is also a balance between letting member programs grow and develop their own character, while also maintaining the trademarks of the Engineering Ambassadors Network. For example, we would like the diversity reported by member schools in 2015 to be even stronger; however, hiring and supervising the Engineering Ambassadors is at the discretion of the universities. If programs meet all the other trademarks, do we exclude someone because they struggle with making the program as diverse as we would like it to be?
One final challenge can also be seen as a success. Some universities have started to establish programs similar to Engineering Ambassadors, but with a focus in a different field. For example, there are now programs called STEM Ambassadors and Science Ambassadors. While we welcome these groups into our trainings, this expanse in focus begs the larger question as to our core focus. We want to welcome these groups and leverage our resources without diluting the engineering mission of the Engineering Ambassadors Network.

We continue to learn from the successes and challenges in scaling this once four-university collaboration. None of the challenges are insurmountable. Examining our successes and challenges continues to help us create a stronger network with unified goals and significant impact.

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