

NAE Engineering Societies Study – Interview Results

The following is a high-level summary of the 30 interviews of engineering societies conducted by Inverness Research. Most of the individuals we interviewed were Executive Directors or Presidents, although there were a few who held other leadership positions. It is worth noting that many of the interviewees began by saying that they did not see their society as an “engineering society,” per se, but one that influences and is influenced by engineering, and includes engineers in the membership.

Goals and Activities

Professional development for practicing engineers is a common focus for societies. Supporting and growing membership is also a goal. Across the sample, it is evident that societies engage in a range of activities depending on the needs of their membership, their available expertise and capacity, and funding. Further, societies may organize geographically and provide different kinds of opportunities for different, local audiences.

For the smaller or specialty societies, a common priority goal is to spread awareness of their particular branch of engineering. They also have some expertise in outreach to pre-college and undergraduates to educate engineers and others about their particular specialty.

Other goals and activities that interviewees mentioned include: engaging students in the community and service learning; ongoing professional development for practicing engineers; ensuring the next generation of engineers is prepared to practice engineering; expanding and protecting the reputation of engineering; professionalizing the engineering field; providing a forum for engineers to interact; promoting quality engineering education through ABET; facilitating career transitions; providing research-based design standards; working with regulators, legislators, and policy makers; and providing more application-based programs.

Concerns about the extent to which students graduating from engineering programs are ill-prepared to work in industry were shared by several societies, as exemplified by this statement:

The biggest complaint we get from our membership of 56,000 engineers is that engineers graduating from engineering programs are not well equipped on an application basis to participate in our industry. There are lots of reasons behind that. So we feel a duty to pick up that mantel and really focus on teaching application, how do you actually do what these folks are asked to do in our industry?

Also important for many societies is retaining and supporting diversity in engineering. One interviewee recalled her own experience as an engineering student to explain how important her society's goals are for many:

I was [an engineering] student in the 70s. It was [this society] that kept me from quitting. Back then there was a lot going on that confirmed I didn't belong. Having a safe place was important - a place where I could exhale and talk to someone who could relate.

Another interviewee described their goals as:

Anything that touches on the precollege, undergrad, lifelong learning of an engineer... we want to ensure it is available, accessible, and excellent.

Activities of societies include: ensuring that degree programs are preparing students for engineering jobs/practice; creating awareness of the discipline (e.g. environmental engineering); providing mentor programs for high school and undergraduate students; providing education for certification programs; providing internship programs to support transitions to work; providing curriculum or support for curriculum at the undergraduate level; providing scholarships; creating and offering webinars and workshops for continuing education; offering accreditation through ABET; offering an early career faculty program; endorsing existing programs such as FIRST Robotics and Project Lead The Way; offering courses and workshops at annual meetings; and partnering students with practicing professionals.

One large society is addressing both the faculty and student experience: it has begun a program for early career faculty to provide them with resources (2-4 hour workshops, networking, mentoring) that will better prepare them for teaching at the university level, and a student program that helps them learn the "difficult to learn" subject matter.

A few societies are more focused on the technician – education programs aimed at high school and community college students who would not likely complete a 4-year engineering degree but aim to work in a job providing engineering or technical support to the engineer.

Overall, most activities of societies are designed to meet the needs of the membership. There are a couple of societies with longer-range views. Finally, there is a growing emphasis on providing programming virtually – through online courses, webinars, and the like.

Evaluation

Most of the societies attempt to collect feedback from participants in their most significant programs but most interviewees noted that they would like to do more to evaluate their work. They tend to collect numbers of participants and programs as indicators of success. As one interviewee said, their evaluation is:

Almost entirely by numbers: numbers of students who receive fellowships or scholarships, number of dollars that go into the fellowships and scholarships, number of individuals or organizations that contribute to the association, number of active chapters.

Many also conduct member satisfaction surveys (i.e. people vote with their feet and wallets), or surveys that help them understand the professional development needs of their membership.

Some interviewees mentioned wishing that they did more to evaluate the longer-term impact of their work. One interviewee said, *“Everyone struggles with that and it takes lots of resources to figure out what are the right metrics.”*

Dissemination

Most societies disseminate their work, education or otherwise, through annual meetings/conferences, journals, websites, member newsletters, and the like. One interviewee said that a formal venue for disseminating or sharing work related to undergraduate engineering education does not exist, but should.

Connections with other societies

Most societies have at least some connections with other engineering societies, although the connections may or may not involve their work in education. Many invite other societies to their meetings, or attend others societies’ meetings. However, few have made substantial connections that have resulted in collaborative projects. Mostly, the connections among societies are about sharing information.

Notable examples of connections among societies include: participation in a network of Executive Directors from other societies; consulting with others when developing curricula; having MOUs with several societies to work in three focal areas (membership reciprocity, curriculum development, and access to training

and licensure courses); and joint professional development workshops or seminars.

One society organized a large coalition of organizations in April of 2016 – 83 people from 42 different organizations to work towards the mission of producing fifty-thousand underrepresented engineers by 2025. This is a striking example of a coordinated and purposeful effort. The representative interviewee said:

What is unique is that we are not all working together on a common program - we are saying leverage your strengths and distinctiveness and work to this common purpose.

As another example, a society benefited from an influx of foundation funding over 15 years ago to advance the educational mission of the domain. The funding allowed the society to organize and offer fellowships, early career awards, professional development for department chairs, and leadership development. The funding also supported two education summits where people across different disciplines exchanged best practices, curricula, lab activities, and courses. These summits provided the benefit of contributions from multiple perspectives for a multidisciplinary field. Unfortunately, the program is now defunct. The society has been able to hold one summit since then and is hoping to do another.

Almost all of the societies interviewed expressed a desire to be more connected to other societies.

Gaps in Engineering Education

Most of the individuals we interviewed believe that many of the gaps in engineering education offerings they see are being addressed in some way, somewhere in the landscape. However, there were a few areas they felt need more concerted effort, such as: faculty preparation to be instructors in engineering; addressing the lack of hands-on/application experiences for undergraduates; a re-focus on the design side of engineering; an emphasis on the business side of engineering (such as financial and general business acumen); support for how to integrate new teaching technologies into the engineering classroom and for preparing engineers for new technologies; getting industry more involved in ABET; turning more attention to the two-year programs and preparedness for the workforce; support for preparing doctoral students for teaching; and preparing students in general for team-work.

One interviewee said there is generally a need for a better understanding of the 1st year experience, *“We need to change the thinking about designing for failure. We need to make student success a focus.”* A few interviewees mentioned a gap in engineering education aimed at the K-12 level. One simply said: *“We don’t have the resources for k-12.”* One notable exception has a program that places high school students in labs in an effort to encourage them to pursue a technical

field. They also provide resources, content, and pedagogical support to teachers at the middle school and high school levels who are teaching the subject but do not have a degree in it.

One society is very involved in filling the pre-college gap, particularly the competencies needed for high school students to be successful in college engineering. Along these lines, another interviewee voiced the need for earlier (than college) exposure to engineering and the diversity within it:

I think what you hear often among societies at large is the feeling that there should be more at the K-12 level. We all draw from people coming out of engineering departments of Universities or Computer Science departments or Business schools, increasingly, as the industry has become more diversified. But I would say one of the challenges is that there aren't enough students coming through the pipeline who want to go through STEM programs. Both the government and other associations are trying things but they are hit or miss. It's important to give students a sense of what careers might look like in those fields.

Similarly, another interviewee expressed the need to reach younger learners if the engineering pipeline is to stay filled:

Societies need to bring the concepts of engineering down to lower level classrooms - high school is too late. How do you do that? It requires exposure, and high school counselors are doing some of that. If kids go to [counselors] and they don't know what engineering is, or what it requires, they are turning kids off from it. The idea of exposing kids at a young age - middle school at the latest - is something that the community could be doing better. Why? To fill the pipeline.

Another interviewee noted that while they don't do any work in the pre-college realm, it is "on the list" as an area they would like to get involved in, particularly teachers.

One Executive Director lamented the current state of undergraduate engineering education:

At the undergraduate level, are we educating the engineers of tomorrow? The curricula have been pretty stable for decades. We are not yet in the environment of tomorrow where it is about being able to learn quickly and be nimble. Are our curricula reflecting where we need to go? We need to look at the paradigm – is it adequate or does it need tweaking?

Finally, an Executive Director felt that the key missing pieces to the development of new engineers is the provision of mentors and real life education. She said:

Students who can only solve problems from the book aren't going to go very far. They are going to run into someone that knows what they are doing. The more you get kids into that kind of [real-world] environment, the better.

Final notes

There are some interesting examples of societies that are either trying new initiatives to reach new audiences (such as a focus on early career faculty) and larger, bold initiatives that involve multiple societies and set out ambitious goals (such as the large coalition). Perhaps these societies could facilitate conversations about their experiences and stimulate thinking around innovative new programs.

It is important to keep in mind that collaborative efforts of any kind take time to both plan and get traction. They take patience and time to build trust and a collective vision. One Executive Director made this important point:

There is never enough money and time for partnerships between like-minded societies could move the needle. It takes time. I was involved with a 10-year, multi-institutional network, and not until year 3-4 did things move. We were all doing our own thing, and then we got money to do more networking... Finding partners and dancing together, that didn't happen for a while. Hosting one summit is not going to make a difference... We need a long-term vision.