Landscape of Engineering Technology Programs as seen from ASEE

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Aimee Ulstad, P.E is an Associate Professor of Practice in the Integrated Systems Engineering Department at The Ohio State University. Prior to joining the faculty at Ohio State, Aimee was an industry professional in various field in engineering for over 30 years. Aimee received her degrees in Mechanical Engineering and Masters in Business Administration from Ohio State. She began her career as a packaging equipment engineer at Procter and Gamble, then moved to Anheuser-Busch where she worked for over 27 years. She worked as project manager, engineering manager, utility manager, maintenance manager, and finally as the Resident Engineer managing all technical areas of the facility. During her tenure, the brewery saw dramatic increases in productivity improvement, increased use of automation systems, and significant cost reductions in all areas including utilities where they received the internal award for having the best utility usage reduction for 2014. Since joining Ohio State, Aimee has joined the American Society of Engineering Educators and serves as the treasurer of the Engineering Economics division.

Ms. Kathryn Kelley, The Ohio State University

Kathryn Kelley serves as executive director of OMI; she has more than 20 years' experience in program leadership and strategic communications at industry-oriented higher education, economic development and statewide technology organizations. She collaborates with state and national partners to develop regional and national public policy to support manufacturing innovation, advocate for small- and medium-sized manufacturing needs within the supply chains and remove barriers between academia and industry.

Activities include: • Managed Ohio Development Services Agency Ohio MEP funded program on "Manufacturing 5.0" to develop a framework and set of tools to guide MEP staff assisting small- and medium-sized manufacturing firms in their journey toward digital integration. • Completed ODSA-funded project on Ohio Advanced Manufacturing Technical Resource Network roadmaps organized by manufacturing processes to determine manufacturing needs and technical solutions for machining, molding, joining/forming, additive manufacturing. • Served as lead coordinator of a Bachelor of Science in Engineering Technology degree program at The Ohio State University focused on curriculum development and approval, securing industry support and promoting program to internal/external audiences. • Collaborated with the Ohio Manufacturers' Association, Ohio TechNet, and others to develop a framework and implementation of regional industry sector workforce partnerships and a statewide image campaign, Making Ohio, to spur manufacturing job growth • Administrated Ohio Department of Higher Education (ODHE) Ohio Means Internships & Co-ops program for the Central Ohio region, including area community colleges, to increase advanced manufacturing experiential learning • Served as Ohio principal investigator on a $2.24M US Department of Defense Office of Economic Adjustment Defense Manufacturing Assistance Program and $300K Defense Cybersecurity Assurance Program

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Background

During the 2019 ASEE Annual Conference held in Tampa, Florida, attendees from Ohio State University who are developing a new Bachelor of Science in Engineering Technology program surveyed engineering technology participants for benchmarking details of their programs. Even though some of this information can be discovered through analysis of the institutions' websites, the details provided in face-to-face conversations reveal more contextual details about some of the underlying decisions related to each program's operational decision-making. During these discussions, the interviewers communicated that we would publish the results of the discussions from our questionnaire. The results of this research could be used in two ways:

- Inform peer institutions about program commonalities, including best practices, issues and challenges
- Allow members of ASEE's Engineering Technology Division to develop common strategies to address some of the challenges that all ET institutions face

Research Data

The data collected at ASEE 2019 Annual Conference was gathered from 12 participants who attended many of the engineering technology program sessions. Some of this data may speak to the nature of participants who attend the conference and not to those who are in the engineering technology space in total. Below are the questions and answers provided by those who were interviewed.

1. What types of program do you offer (2-year or 4-year)?
   4-Year BSET Program – 100% (12/12) offered this degree
   2-Year Associate Program – 17% (2/12) also offered this degree
   Masters or PhD Program – 33% (4/12) offered this degree

   Interestingly, few institutions offering only associate degrees in engineering technology have representation at this conference. We found none, but some could have been overlooked.

2. What majors do you offer?
   Many majors and variations were described, but the following were broken into the top seven.

Major	# of Institutions (Of 12)	%
Mechanical Eng. Technology	9	69%
Manufacturing Eng. Technology	6	46%
Electrical Eng. Technology	8	62%
Mechatronic Eng. Technology	3	23%
Industrial Eng. Technology	5	38%

Robotics Eng. Technology	3	23%
Computer Eng. Technology	3	23%
Construction Eng. Technology	8	62%

It was interesting that Manufacturing, Industrial, Mechatronic, and Robotics have a significant amount of overlap in content, but there is a proliferation in the different naming of these programs today.

3a. How are your courses delivered (face to face, online, or hybrid)?

Delivery Mode	# of Institutions	%
100% Face to Face	2	17%
~ 70 %+ Face to Face, ~30% Online	9	75%
~50% Face to Face, 50% Online	1	8%
~ 30% Face to Face, 60%+ Online	0	0%

Most institutions are heavily focused on face-to-face delivery of the courses, with upper division courses being offered more online as students have busier schedules and more have more significant jobs. Also, as students mature, they can better handle more online courses that require a high level of self-directed learning.

3b. When are your courses delivered (day or evening)?

This question was not answered by many of the participants, but the general perspective of those that did answer was that the majority of the beginning courses were held during the day.

Question 3a and 3b together paint the picture that the students attending the BSET program are more traditional college-age students taking face-to-face classes, participating in labs, and doing traditional assignments. As they move through the program, they may obtain more demanding jobs as their skills increase. The programs then adapt by creating more online courses, evening courses, and ways to accommodate working students.

4. How many students do you graduate per year?

Graduates per year	# of Institutions	%
0-30	0	0
31-60	2	20%
60-99	4	40%
100+	4	40%

This information reinforces the other data that participants attending ASEE are from the larger BSET schools.

5. What are the biggest barriers to getting students to start the program successfully (more than 1 answer is acceptable)?

Barrier	% of Institutions	%
Math Preparation	6	29%
Academic Rigor/Preparation for difficulty	7	33%
Financial	6	29%
Lack of clarity about what this program is all about	2	10%

6. What are the biggest barriers to students completing the program (more than 1 answer is acceptable)?

Barrier	% of Institutions	%
Personal Maturity	4	29%
Working too much (Financial Needs/priority)	5	36%
Academic Preparation	5	36%

7. What do you feel could be done to address challenges to students entering the program and barriers to completion?

Answers to these questions generally hit on three themes: (1) Be selective - ensure students coming to the program have academic skills to succeed. (2) Have strong counselors, peer mentors, and student success offices to help focus students. (3) Financial planning - look at how they can afford to pay for all four years, not just this semester.

8. Do you have many incumbent workers in your program focused on up-skilling?

The number of incumbent workers who are people with a technical type job (maintenance or associate degree) trying to up-skill is very small. This reinforces the notion that the entrants into most of the BSET programs are college-age students.

9. What have you found that has been successful in attracting and retaining diverse candidates?

There was no clear answer to this question. Most groups acknowledged that the BSET programs were probably less diverse than even traditional engineering degree programs. Some school representatives said, “Our school is better than most,” but there was no data on this question.

10. What is your primary source for finding faculty? B) How have you overcome challenges? C)Have you hired traditional faculty and offered them the opportunity to work in industry over the summer?

Faculty hiring was widely acknowledged as a big problem. Some institutions require PhD-level candidates and 3+ years industry experience which is extremely difficult to find. In addition, most academic institutions don’t pay commensurate to industry for

these levels. There was no magic bullet identified here and no institution offered to provide their faculty a nine-month appointment with a three-month summer to work in industry.

11. Do you require internships in your program?

    All participants said they do not require internships, but highly recommend them and work with students to help them land these valuable opportunities. They said that if required, it would be incumbent upon their institution to ensure that the students could all obtain the internships, which might not be possible for all students due to problems like visa requirements.

12. How do you maintain curricular alignment with local industry?

    Most participants answered that they meet regularly with their industry advisory board (1-2 per semester) and use this to discuss how these needs are being met. Further, about 30% of the participants also said industry sponsored capstones are a good source of valuable feedback on whether the needs of local industry are being met.

Conclusions

Students beginning in engineering technology are most likely to be your traditional college students. They attend majority face-to-face course delivery in their lower-level classes. As students move into their upper division classes, they may take more online courses in some institutions.

Major challenges that don't seem to be easily overcome include:

- Increasing diversity
- Finding faculty with industry experience at wages paid by educational institutions
- Ensuring students are supported sufficiently to be successful in the transition from high school to college

Special Thanks

Special thanks for the participants from the 2019 ASEE Conference ETD for supporting this research which will help our institution understand the target audience and challenges as we proceed to start a BSET program.