



Industrial Advisory Board Open Forum

Dr. Charles E. Baukal Jr. P.E., John Zink Co. LLC

Charles E. Baukal, Jr. has a Ph.D. in Mechanical Engineering, an Ed.D., and Professional Engineering License. He is the Director of the John Zink Institute which offers continuing professional development for engineers and technicians. He has nearly 35 years of industrial experience and 30 years of teaching experience as an adjunct. He is the author/editor of 13 books on industrial combustion and is an inventor on 11 U.S. patents.

Dr. Ted Song, John Brown University

Dr. Ted Song joined the JBU engineering faculty in August of 2012. Dr. Song received his Ph.D. in Electrical and Computer Engineering from the University of Texas at Austin in 2012, and his doctoral dissertation is in the area of mathematical modeling of renewable energy sources (e.g. photovoltaic and wind) and energy storage system (e.g. lithium-ion battery). In addition, his current research interests include renewable energy technologies that can be effectively implemented in developing countries.

Dr. Will C. Holmes, John Brown University

Dr. Will Holmes is an associate professor of engineering at John Brown University in Northwest Arkansas. Prior to coming to John Brown University, he spent ten years at Taylor University in central Indiana. Prior to that appointment he received his PhD from Washington State University in Materials Science and Engineering. Dr. Holmes enjoys teaching a wide variety of classes and involving students at all levels of undergraduate study in team based design projects and project based learning. Contact: wholmes@jbu.edu

Kyle Crouse, John Brown University

Kyle Crouse is a junior in engineering (with an electrical/computer concentration) at John Brown University. He is the Head of Communications and Treasurer of the JBU IEEE Student Branch and is currently working with a team to design a low-cost maximum power point tracker (MPPT) for use with solar panels in developing countries. Kyle is passionate about engineering and music and aspires to work in the audio technology industry following graduation.

Mr. Zachary Jordan Lee, John Brown University

Zachary Lee is a Junior Electrical/Computer Engineering student at John Brown University with interests in computer programming, renewable energy, and smart grid technologies. He is the President of the JBU IEEE Student Branch, and is a member of the Honors Scholars Program and Leaders Scholars Institute. He is also an IEEE Power and Energy Society Scholar. Zachary is passionate about using engineering as a platform to help others through humanitarian engineering projects and education.

Mr. Cameron Drax Geiger, John Brown University

Drax is a sophomore engineering student at John Brown University (JBU) pursuing his B.S. in Engineering with a Concentration in Mechanical Engineering and an Enhancement in Renewable Energy. He is the Vice President of Activities for JBU's IEEE student branch, and plans to pursue graduate work in Leadership Studies.

Industrial Advisory Board Open Forum

Abstract

John Brown University (JBU) uses its engineering industrial advisory board in a unique fashion which is helpful for its students, fun for the board members, and useful for the faculty and university. During one of its regular Industrial Advisory Board meetings, JBU arranges an Open Forum Panel where students are encouraged to ask board members any questions they may have. These questions cover a very broad range of student interests including, for example, how to get an internship, what industry is looking for when hiring new graduates, the utility of getting a professional engineering license, and how to prepare for admission to graduate school. After a recent forum, a survey was given to the students with 61 responding. The overwhelming response was very positive and included suggestions for improving future forums.

Introduction

Industry-University Collaboration

There are many ways that industry and academia can collaborate to educate engineering students. Industry can provide individual instructors to teach existing courses as adjuncts or visiting professors.¹ Industry can help provide new course content, for example for emerging technologies, which can be taught by academia.² Industry adjunct instructors can temporarily fill in for faculty on sabbatical or on leave,³ help handle temporary increases in student course enrollments,⁴ relieve full-time faculty so they can do research,⁵ or co-teach with full-time faculty to help bring professional practice into the classroom.⁶ Adjunct instructors can also teach specific topics in a course where faculty are less knowledgeable,^{7,8} teach entire courses outside the specific area of expertise of the faculty,^{4,9,10} and teach courses at off-campus locations.¹¹ In a somewhat unique partnership, two companies and two universities partnered to deliver a face-to-face and online version of a senior elective course.¹² Industry can partner with universities to provide guest speakers to educate students about various aspects of the “real world” of engineering.¹³ Companies can host field trips where universities visit local industrial facilities to see actual equipment in operation.¹⁴ Cooperative positions and internships allow students to work side-by-side with engineering professionals to see how the principles learned in class are applied in actual practice.^{15,16} Industry sponsors senior design projects to produce products and processes of interest to them while simultaneously educating students by allowing them to apply their knowledge and skills to real-world problems.¹⁵ Some universities have used industry to help teach senior design courses as part of capstone projects,¹⁷ where these adjunct instructors are sometimes referred to as “Professors of Practice.”¹⁸ Industry can sponsor research projects with faculty that also include student workers and can also provide facilities for students to conduct research if these are not available at the university. Industry can provide formal mentors for university students and participate in supervisory thesis committees for graduate students,⁹ including sponsoring industrial theses that are carried out in industry.¹³

One of the major benefits of these collaborations is that students gain exposure to actual engineering practice, which can differ significantly from students’ university courses. For example, in many courses, theory is developed and equations are derived. However, in practice, engineers are told to use the equations that someone else has already derived. The key for the

practicing engineer is to know which equations to use, which students hopefully learn in their course work. In universities, it would be impossible to teach students about every area of technology, so most newly graduated engineers need to complete further training with their employer in specific areas of technology. Without exposure to real practice, students may naively believe their education is complete upon graduating with their Bachelor's degree, when in reality their training has only just started.

Industrial Advisory Board

An important type of collaboration between industry and universities is having experienced industry professionals serve on university engineering advisory boards to provide ongoing advice to the programs on a wide range of issues.¹⁹ Davis (2006, p. 3) defined advisory groups or committees as “a collection of individuals who possess unique understanding, knowledge, and skills which complement the talents of the program’s leadership and faculty in order to guide the program more effectively.”²⁰ According to Summers (2002, p. 1), “Industrial advisory boards provide a vehicle to help educational institutions execute their mission and attain their goals.”²¹ Some of the functions of these boards include fundraising, employment of graduates, assisting as constituents in the accreditation process, curriculum review, part-time/summer student employment, sources for senior design projects, and faculty professional development.^{19,22,23}

These boards often consist of a mixture of alumni and non-alumni, industry, retired professors, and sometimes faculty members from other institutions. Alumni who are relatively recent graduates can provide valuable feedback about how well the program prepared them for employment, especially compared to graduates from other institutions. Board members may come from both the private and public sectors. While logistically most board members are typically located close to the university, this is not a requirement as long as members located at a distance can effectively participate. It is not necessary that all board members are engineers, although the majority would normally be. Ideally the board will be diverse and have a range of experience and management levels, from a range of industries. This diversity helps give the program a variety of perspectives when addressing current issues and planning future direction.

Some universities look for high-level executives to serve on their boards who may be potential donation sources or who may have significant influence that could benefit the program. While there is not necessarily anything wrong with that strategy, there are some potential pitfalls. Higher-level people are often extremely busy and may not have the necessary time to devote to the program. They may also have little if any contact with university students, although they may influence the hiring process. These factors should be considered when selecting advisory board members, as the selection process may not be as easy as it seems.²⁰ An important element is that board members should have a passion for the program and a service mentality. They must also be aligned with the missions of both the program and the institution.

The advisory board is usually a key stakeholder as part of the accreditation process.²⁴ An important role of the board is to help the program keep in touch with the trends and needs of industry.²⁵ Another important function of the board should be to help set the strategic direction and provide advice on a variety of issues.²⁰

The advisory board at JBU consists of about ten members who are approximately equally divided between alumni and non-alumni. Most members work in industry within about a four-hour drive, but there are also some retired faculty as well. All members are engineers who have a range of experiences in a range of industries. There is a balance of newer members and longer-term members. Most have considerable hiring experience including hiring interns and new graduates and supervising graduate students. Some have advanced degrees and some are licensed professional engineers. The board meets for most of the day on a Friday, twice a year near the end of the fall and spring semesters. One of the sessions at each fall meeting consists of board members meeting with the students in an open forum, which is discussed next.

Open Board Forum

Format

All of the board members, except for retired faculty, meet with JBU's approximately 200 engineering students for about an hour after lunch to answer any questions they may have. The forum is held in a room that comfortably handles everyone. There are multiple handheld microphones for the board members and for the students so everyone can clearly hear both the questions and the responses. This open board forum replaces engineering classes during the event, which makes it possible for all engineering students to participate. Current faculty members are present as well and sometimes participate in asking questions. Board members briefly introduce themselves and then the forum is opened up for questions. Sometimes, whoever is leading the meeting for the university will start the process by asking the board one or more questions. While any board member may answer a question, questions may be directed to a particular board member based on their background, experience, and/or answers to previous questions.

Time permitting, students are also invited to meet with board members after the forum formally concludes. Since the advisory board still has other sessions planned for that day, they typically only have a few minutes to talk with students after the forum. However, contact information can be exchanged for more extensive future discussions. This approach is beneficial to both students and board members as some students take advantage of these contacts to pursue possible future employment as an intern or as a full-time employee after graduation and board members who participate in the hiring process use this opportunity to better evaluate and select students that are well prepared for possible job openings.

While these forums have been held for many years at JBU, two innovations were employed at the most recent forum. First, a student club, the JBU IEEE student branch led the meeting. In previous forums, a current faculty member facilitated the meeting. As students took charge of preparing this forum, there was a larger number of students who participated and the forum became a more student-focused event. Second, the student leaders (co-authors on this paper) enabled students to text or post questions using cellular phones or internet-connected devices, both before and during the forum. The ability to send in questions beforehand gave students time to put some thought into issues of interest to them, and students who facilitated the discussion were able to recognize some of the most asked questions; having this information helped students to better engage with board members during the forum. Asking questions through

texting/posting also provided a way for all students to participate as some students are hesitant to speak before a large audience to ask their questions.

Benefits

Students benefit from this forum because they can ask questions of very experienced professionals, something most of them hope to be some day. Of particular interest to many students is getting a job upon graduation, so board members can offer some sage advice as many have been involved in the hiring process for many years. While this forum could benefit all students who participate, there are specific benefits to each class of students—e.g., freshman, sophomore, junior, and senior students.

First, this forum is a great opportunity for freshman students to create expectations for their studies. As many of them do not know what to expect after their college education, this forum gives them a chance to see what type of work they might do if they work in industry. This may help improve retention rates as the forum helps motivate freshman students of the importance and value of their classes, which is critical as most of them will not take major engineering classes until the beginning of their sophomore year.

Sophomore and junior students may benefit as they seek industry internships. In this group, there are some students who are unaware of the importance of having internships before graduation; however, this forum gives them a chance to evaluate their current goals and plans.

Finally, senior students benefit from hearing board members' experiences as some of them are in the process of making their first critical professional decision. For example, some students are about to choose an offer from multiple offers, and some students are still seeking job opportunities after graduation. Having board members' shared experiences helps senior students to better understand important factors to consider when making these decisions.

Since all students are required to attend this approximately one-hour forum, all can benefit from the discussions. As mentioned, students who are just beginning their academic journey benefit by getting information that can help them get internships and take appropriate elective courses. More experienced students can focus on getting a permanent job after graduation or getting into graduate school.

Moreover, these forums can be particularly helpful in dispelling potential student myths. For example, students sometimes believe they will be primarily doing calculations as an individual for an employer and that communication and teamwork skills are not that important. Invariably this topic comes up during a forum and board members consistently and vigorously emphasize the importance of both written and verbal communication skills and working effectively on multidisciplinary teams. In addition, many students are curious about the need for a graduate degree in business, and board members' experiences with regard to business degrees help students better understand what may or may not be needed to pursue their future professional goals.

While these aforementioned topics are already discussed in classrooms, usually led by current JBU faculty members as most of them have experiences with industry, this forum is very beneficial to faculty members as well. Some students sometimes fail to notice the importance of

understanding the nature of industry even though this is often mentioned in classrooms, and they lose focus on properly preparing themselves. However, students tend to better pay attention when experienced professionals from industry share their thoughts and experiences as they deal with these practices, e.g., hiring, every day. For this reason, some faculty members use this forum by asking questions to confirm the general truth for students so that students will be better prepared for their future jobs. In addition, faculty members benefit from board members' answers in some areas that faculty members do not have expertise in, which helps faculty members to better guide students in some specific areas of engineering.

Experienced professionals are often interested in giving back to their professions and serving on an advisory board is one such way. These open forums are particularly satisfying for board members who have the opportunity to give seasoned advice to those who will be entering the profession in the near future. This includes sharing how careers can change dramatically over time. The insight seasoned professionals get into current student attitudes, expectations and concerns, as gleaned from the questions and interaction following the forum, may also be helpful to them as potential employers.

Faculty benefit by hearing feedback on a range of issues, which can be helpful as they provide future guidance to their students. Advisory board feedback can also be used in the periodic review of program educational objectives as required for ABET accreditation.²⁵ Students receive advice regarding career matters as required by ABET.

Student Survey

The students who led the most recent forum developed and administered an anonymous survey of their fellow students regarding the forum. Sixty-one surveys were returned, a few of which had unanswered questions. The survey had five multiple-choice questions and four open-ended questions, which are discussed below.

1. What year are you (Freshman, Sophomore, Junior, Senior)?

As shown in Figure 1, most of the respondents were freshman and juniors, with far fewer sophomores and seniors.

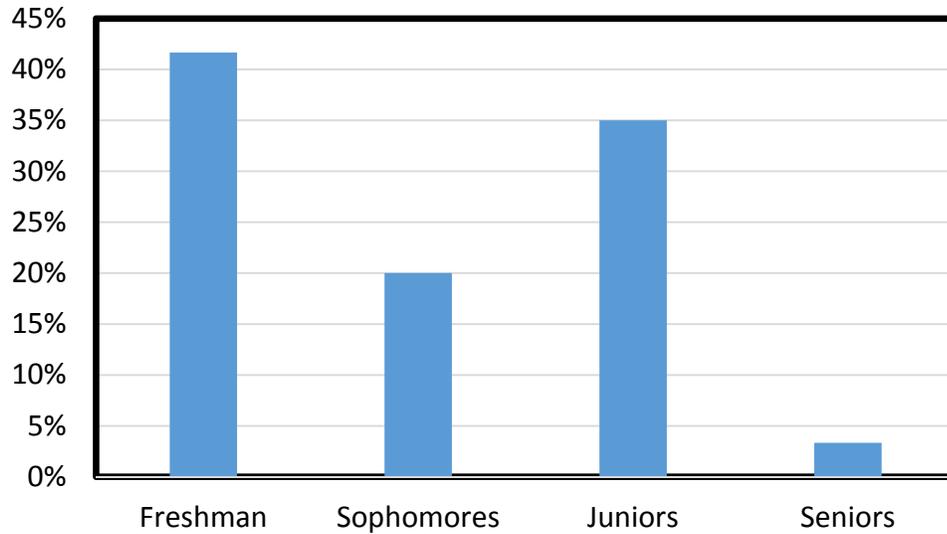


Figure 1 Year in school for survey respondents.

2. What is your concentration (Mechanical, Electrical, Renewable, Electrical / Renewable, Mechanical / Electrical)?

The engineering program at JBU consists of an ABET-accredited general engineering program with concentrations in Mechanical, Electrical, or Renewable Energy. The concentration for over half of the respondents was mechanical engineering and for nearly a third was electrical, with much fewer renewable, electrical / renewable, and mechanical / electrical.

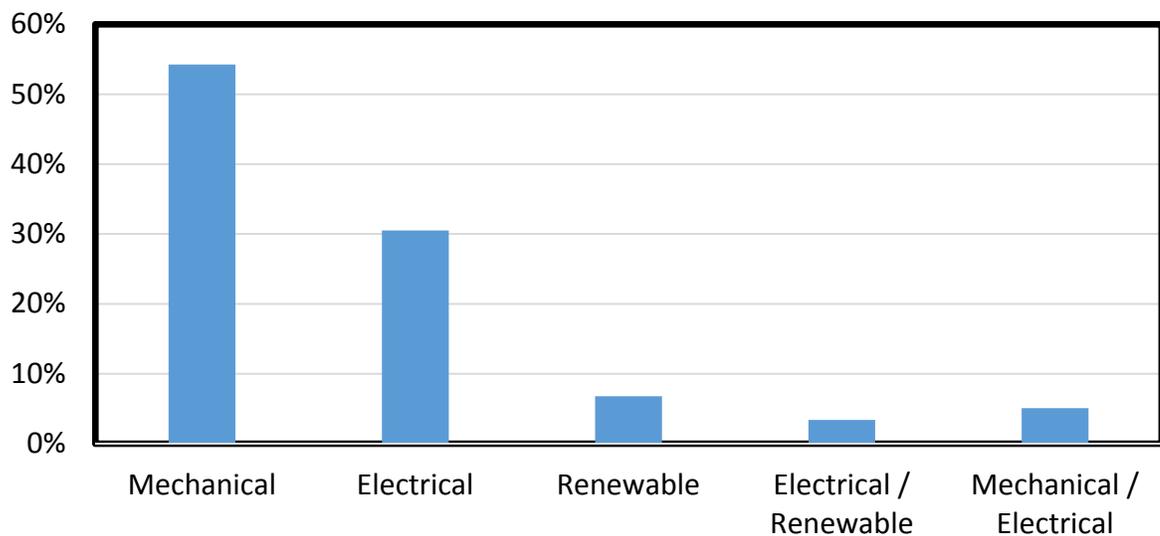


Figure 2 Engineering concentrations of the survey respondents.

3. Was the length of the forum too short, just right, or too long?

As shown in Figure 3, over two-thirds of the respondents felt the forum length of approximately one hour was just right. Nearly a quarter felt it was too long and a few felt it was too short.

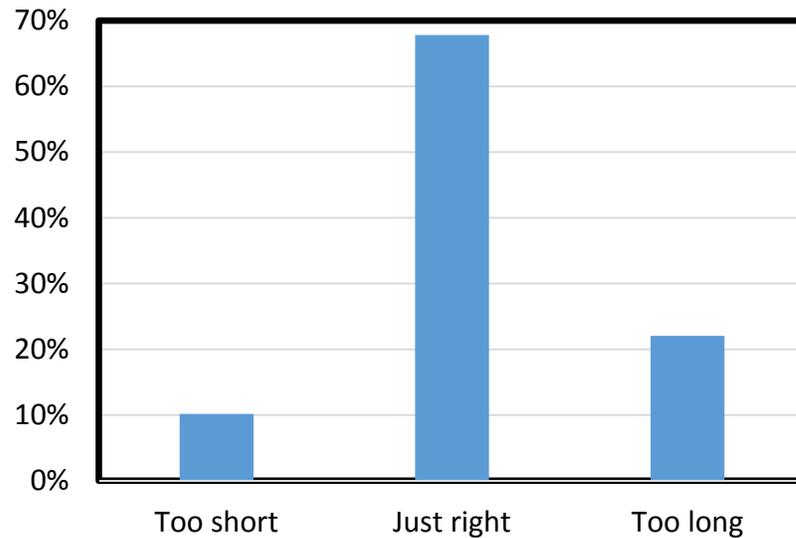


Figure 3 Survey respondents opinion about the length of the forum.

4. How did you feel about the option to text in questions (Unnecessary, I wouldn't have asked my questions otherwise, Indifferent)?

Based on Figure 4, over a quarter of the students felt the text in option was necessary for them to ask a question with only a small fraction who felt it was unnecessary. Most were indifferent to this option.

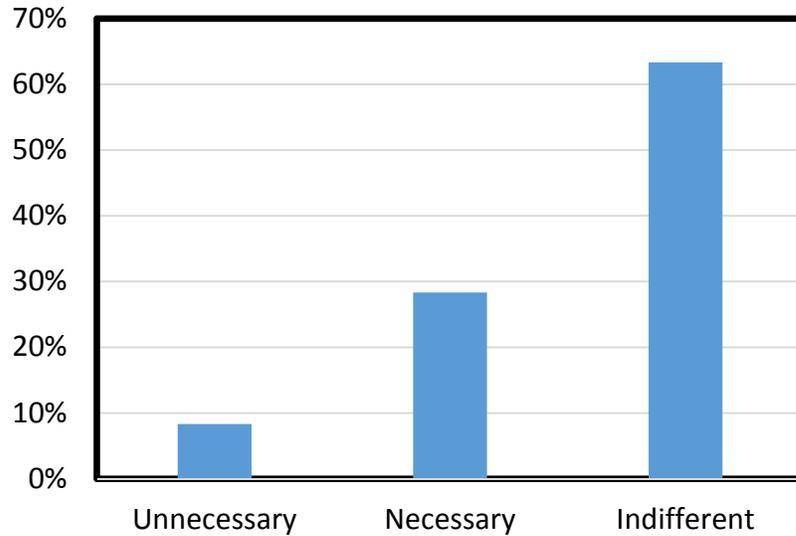


Figure 4 Respondents opinion of the option to text in questions.

5. Should attendance at the forum be mandatory (Yes, No)?

Most respondents felt attendance at the forum for students should be mandatory although a significant percentage felt it should not be (see Figure 5).

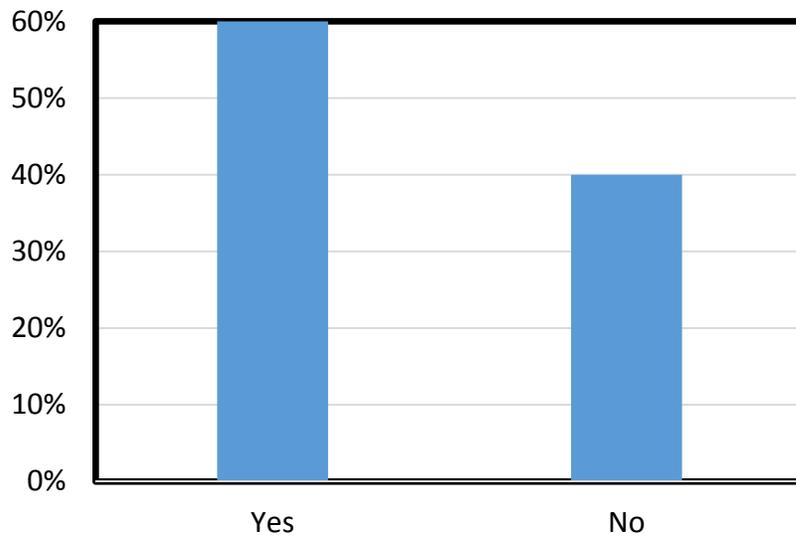


Figure 5 Respondents belief about whether student forum attendance should be mandatory.

6. What did you find valuable about the forum?

Students appreciated the opportunity to learn from industry engineers about what's expected of graduates and to hear from industry engineers about life and work. They

were able to compare industry engineers' opinions with their professors' opinions. They also liked the diversity in the board members' answers and industries.

7. What did you find unnecessary or useless about the forum?

Some did not feel attendance at the forum should be necessary (see question 5 above). Some felt certain questions were too specific to a particular student, repetitive (either in this session or from previous years), or focused on social issues. Some felt the option to text in questions was unnecessary (see question 4 above), there was too much focus on jobs rather than graduate school, there were distracted students (asleep or on phones), and some of the responses were too generic.

8. Did you learn anything from the forum that will change your future plans for engineering? If so, what did you learn?

Some of the general responses included improving communication skills, getting a broad knowledge base (not just in one's chosen concentration), finding a career that meets one's passions, and not procrastinating in choosing a career direction. Some of the comments related to graduate studies included: working before going to grad school, getting a Master's degree through one's employer, combining engineering and business, the value of graduate degrees, and the importance of a graduate degree in focusing knowledge in a particular field of technology. Related to career, some of the comments included: the importance of internships, the first job may not be a perfect fit, apply for many jobs, not everything learned in courses will be used on the job, and most engineering skills are developed on the job.

9. What suggestions do you have for improving the forum?

Regarding the board members and their answers, some respondents suggested giving recommendations and advice instead of generic answers, talking about job / internship opportunities at their companies, more spiritually-focused answers for workplace-related questions, more information about graduate school, more about members' experiences from college graduation to the present, discussion about specific board member projects and how they use engineering in those projects, and having members talk more rather than just answering questions.

Respondents also had some recommendations regarding logistics and coordination, including offering incentives to encourage attendance rather than making it mandatory, making the forum more engaging, suggesting students bring a pencil and notebook, scheduling the forum when no other classes are scheduled (beyond just engineering classes) so no classes need to be missed, giving more advanced notice of the forum, better seating for improved visibility, providing refreshments, and providing a handout with brief bios of each board member.

Respondents also had some suggestions for improving the questioning process: allowing faculty to ask questions, spending less time on any single question, projecting questions onto a screen, posting notes online after the forum, and including more questions on internships.

Some of the notable respondents' quotes included:

- “I thought it was very valuable to get to hear from engineers with a different perspective. We often hear what our professors think is important, but hearing engineers who are out in industry say the same thing, or even disagree with our professors gives us more information to make good decisions.”
- “All things mandatory lose about 50% enjoyment or learning value regardless of content quality.”
- “Engineering is more than a math problem. You have to be able to think critically and be able to communicate.”
- “There is an absolute ton of stuff to do under the category of ‘engineer.’ Learning to be an engineer can be useful in a lot of different areas other than engineering.”
- “[The forum was valuable as it gave] the opportunity to hear different opinions on things students are curious about.”
- “...it solidified my choice to not go to grad school right away.”
- “It provided insight into the life of an engineer after college.”
- “I enjoyed valuable feedback and insight into the possibility of pursuing business after getting an engineering degree.”
- “It was very interesting to find out that after you get a job, your job could pay for you to get further education in your field if you (decide) to or if they need you to.”
- “...it gave me a broader scope of more opportunities and got me to think beyond the next two years.”

Conclusions and Recommendations

The main purpose of the forum is to provide advice and guidance to students. Based on the survey results, it appears this objective is being met. The ability to text in questions was a benefit for some students but is not a requirement. The forum should have adequate seating for the expected participants and should have a time limit where about an hour seems appropriate. If it is too long then there is likely to be too much repetition and declining interest. Topics for discussion could be limited if time is a concern. If the forum is too short then students will not get enough of their questions answered and may leave frustrated and disappointed.

There was some disagreement among the students as to whether forum attendance should be mandatory or not. Ideally, the forum would be scheduled at a time when there are few if any conflicts with classes so they don't need to be canceled. However, that is probably not possible as such a time would likely be inconvenient for either the students and/or the board members. The schedule impacts the decision regarding mandatory attendance. If the forum is scheduled at a time when many students have classes and the classes are not canceled, then making attendance voluntary would likely discourage students from attending for fear of missing valuable instruction time. Also, low student forum attendance would probably be a waste of board members' valuable time. If students have never attended such a forum, they will not really know its true value and may not be in a good position to determine whether or not they should attend. The decision for mandatory vs. voluntary attendance should be determined by the faculty.

While the advisory board open forum takes very little time (maybe an hour a year), as can be seen by the student feedback it can provide very valuable information that can positively impact

their future decisions. However, the forum can also provide benefits to the advisory board members, particularly the satisfaction of providing potentially life-enhancing advice and guidance to the next generation of engineers. It may also provide these professionals insights into current program curricula, teaching methods, student attitudes and other things that may benefit them as employers. The program leaders and faculty may benefit from these forums as well by providing useful information that can be used to improve the program. These forums are a powerful example of college-industry partnerships. A relatively minimal investment of time has the potential to provide life-changing advice to students.

References

1. N.A. Lewis, The engineer as a professor: Bringing experience to the engineering classroom, presented at the ASEE Mid-Atlantic Section meeting, U.S. Military Academy at West Point (New York), March 28-29, 2008.
2. K. Korhonen-Yrjänheikki, T. Tukiainen, and M. Takala, New challenging approaches to engineering education: Enhancing university-industry co-operation, *European J. Engineering Education*, Vol. 32, No. 2, pp. 167-179, 2007.
3. J.P. Gosink and R.A. Streveler, Bringing adjunct engineering faculty into the learning community, *J. Engineering Education*, Vol. 89, No. 1, pp. 47-51, 2000.
4. A. Rose and N. Voigt, The role of adjunct faculty in future engineering, proceedings of the 2008 American Society for Engineering Education Annual Conference & Exposition, paper AC 2008-2046.
5. V. Varma, Practitioners as adjunct clinical professors: Their role in teaching real-world engineering applications in design and construction, proceedings of the 2009 American Society for Engineering Education Annual Conference & Exposition, paper AC 2009-304.
6. W. Akili, Integrating practical experience in a geotechnical/foundation engineering class: The role of the adjunct faculty, proceedings of the 2005 American Society for Engineering Education Annual Conference & Exposition, pp. 8423-8436.
7. P. Dunn, Creating industrial partnerships with construction-management technology programs, proceedings of the 2009 American Society for Engineering Education Annual Conference & Exposition, paper AC 2009-1114.
8. K. McManus, The effects of integration of industry faculty into a construction management postgraduate coursework program in the Australian environment, proceedings of the 2007 American Society for Engineering Education Annual Conference & Exposition, paper AC 2007-1562.
9. C. Baukal, J. Colannino, W. Bussman, and G. Price, Industry Instructors for a Specialized Elective Course, Paper AC 2010-67, proceedings of 2010 American Society for Engineering Education conference, June 20-23, 2010, Louisville, KY.
10. F.S. Gunnerson, R.T. Jacobsen and G. Pillay, A strategic alliance between regional universities and industry at a national laboratory, proceedings of the 2002 American Society for Engineering Education Annual Conference & Exposition, pp. 3895-3903.
11. J.V. Farr and D. Verma, Involving industry in the design of courses, programs, and a systems engineering and engineering management department, proceedings of the 2002 American Society for Engineering Education Annual Conference & Exposition, pp. 495-502.
12. C.E. Baukal, G.L. Price, G.D. Silcox, M. Newton, and T.L. Phipps, Local and Remote Unrelated Universities Partner on Industry-Taught Course, proceedings of the 2013 American Society for Engineering Education Annual Conference & Exposition, paper 6076.
13. W.W. Massie, Bringing practitioners (and practice) into the curriculum, proceedings of the 2004 American Society for Engineering Education Annual Conference & Exposition, pp. 1303-1311.
14. D.J. Fournier and C. Gaudet, Creating relationships with industry to advance new programs, proceedings of the 1999 American Society for Engineering Education Annual Conference & Exposition, pp. 1405-1410.

15. Z.O. Keil and M. Basantis, An industrial internship program to enhance student learning and marketability, proceedings of the 2000 American Society for Engineering Education Annual Conference & Exposition, pp. 845-850.
16. I. Dabipi and J. Arumala, Enhancing engineering education through real-life projects, proceedings of the 2007 American Society for Engineering Education Annual Conference & Exposition, paper AC 2007-3031.
17. R.C. Knox, D.A. Sabatini, R.L. Sack, R.D. Haskins, and S.W. Fairbairn, A practitioner-educator partnership for teaching engineering design, *J. Engineering Education*, Vol. 84, No. 1, pp. 1-7, 1995.
18. J. Ochs, G. Lennon, T. Watkins, and G. Mitchell, A comprehensive model for integrating entrepreneurship education and capstone projects while exceeding ABET requirements, proceedings of the 2006 American Society for Engineering Education Annual Conference & Exposition, paper AC 2006-1330.
19. S.R. Genheimer and R.L. Shehab, A Survey of Industrial Advisory Board Operation and Effectiveness in Engineering Education, *Journal of Engineering Education*, Vol. 98, No. 2, pp. 169-180, 2009.
20. D. Davis, Collaborating with Industry via Your Advisory Board, proceedings of the 2006 American Society for Engineering Education Annual Conference & Exposition, paper 2006-397.
21. M.L. Summers, Developing a College-Industry Relationship: The Use of Industrial Advisory Boards, proceedings of the 2002 American Society for Engineering Education Annual Conference & Exposition, Session 3149.
22. J.J. Coe, Engineering Advisory Boards: Passive or Proactive?, *Journal of Professional Issues in Engineering Education and Practice*, Vol. 134, No. 1, pp. 7-10, 2008.
23. J.W. Jones, More than Advice: Increasing Industry Advisory Board Member Involvement, proceedings of the 2014 American Society for Engineering Education Annual Conference & Exposition, paper 9498.
24. ABET, Criteria for Accrediting Engineering Programs, 2015-2015, www.abet.org/eac-criteria-2015-2016/, accessed January 19, 2015.
25. P.R. Schuyler, H. Canistraro, and V.A. Scotto, Linking Industry & Academia: Effective Usage of Industrial Advisory Boards, proceedings of the 2001 American Society for Engineering Education Annual Conference & Exposition, Session 3247.