ASEE 2022 ANNUAL CONFERENCE
Excellence Through Diversity
MINNEAPOLIS, MINNESOTA, JUNE 26TH-29TH, 2022 ASEE
Paper ID #37013

Employer and Student Mismatch in Early-Career Skill Development

Alyson Grace Eggleston

Dr. Alyson Eggleston is a cognitive linguist specializing in the impact our speech has on the way we think and solve problems. She is the founding Director of Technical Communication at The Citadel, and has developed a project-based technical communication course that serves over 14 STEM majors and several degree programs in the social sciences. She is also acting Residential Fellow for the Center for Excellence and Innovation in Teaching, Learning, and Distance Education, and in this role regularly mentors faculty and facilitates workshops on instructional design, Quality Matters assessments, and novel edtech applications. She is also the acting liaison for the Office of Institutional Assessment and Accreditation, and creates online assessment resources and facilitates webinars and workshops to all levels of administration and faculty to demonstrate how to leverage assessment data in service to continuous programmatic improvement and resource acquisition. Her research interests include STEM communications pedagogy, cognitive empathy, industry-academia interaction, teaching and learning.

Robert J. Rabb (Chair, Mechanical Engineering)

Professor, Mechanical Engineering, The Citadel

Ronald W. Welch (Professor) (The Citadel)

Ronald W. Welch, Ph.D., P.E., F.ASCE, F.ASEE, F.SAME Professor of Civil Engineering Ron Welch received his B.S. degree in Engineering Mechanics from the United States Military Academy in 1982. He received his M.S. and Ph.D. degrees in Civil Engineering from the University of Illinois, Champaign-Urbana in 1990 and 1999, respectively. He was Dean of the School of Engineering at The Citadel from 1 July 2011- 30 June 2021. He is currently Professor of Civil Engineering at The Citadel after completing a sabbatical. Prior to his current position, he was the Department Head of Civil Engineering at The University of Texas at Tyler from Jan 2007 to June 2011 as well as served in the Army Corps of Engineers for over 24 years including eleven years on the faculty at the United States Military Academy where he retired as a Colonel.

Employer and Student Mismatch in Early-Career Skill Development

Abstract

Students, early-career engineers, and employers disagree on the relative importance of so-called 'soft skills' and communication in the context of internships and early hiring. This misunderstanding arises because students and companies misidentify each other's value systems. Students seeking internships are hesitant to approach company recruiters, thinking the companies are looking for someone technically proficient in a particular field. Companies understand that students have not completed their undergraduate curriculum and lack technical knowledge. However, companies are seeking students to develop into prospective long-term employees and value students' communication and professional skills over technical knowledge. Many industry partners of The Citadel specialize in proprietary products or support the nation's defense. For this reason, employers have no expectation that students or recent graduates will have technical knowledge in a specific domain. However, employers search for students who can listen, take direction, and deliver results. Comparing a counterbalanced, Likert-scaled survey of engineering students attending career networking events and a survey targeting over 50 employers, we find significant perception gaps in communication and relative student performance and preparedness for networking events.

Identifying perception gaps, or blind spots, ensure our engineering graduates matriculate with career-readiness. While students' definitions of what constituted 'professional skills' were narrow, employers grouped nearly all tasking actions as communication-related or dependent on good communication. Similarly, students believed themselves to be well-prepared for networking events, and deemed their performance as adequate. Early-career engineers, too, underestimated the relative importance that employers attributed to communication skills, as well as the impact communication skills have on promotion and hiring decisions. These findings are well supported by employability research, where countries like Malaysia, India, and Japan have instituted educational policy initiatives to formalize industry partnerships as on-campus experiences.

Identifying significant response differences with regard to the definition of professional skills, the importance of communication skills, and personal preparedness provides a unique dataset to guide continued curricular improvement throughout the engineering degree path. This report is part of a larger, mixed-methods study that seeks to close communication skill gaps in developing engineering students and create an ABET-informed approach to embedding communication skill scaffolding into a traditional 4-year engineering curriculum. Career Services and support personnel within the School of Engineering at The Citadel coordinated access to the industry partners that were surveyed.

Introduction

Employability and the skills that define it have been described in several different ways; however, most definitions converge upon attributes such as teamwork; communication; leadership; critical thinking and problem-solving. Specific definitions are less important than the shared focus, identified here. However, Holden and Jameson [1] define employability as

attributes such as proactive, analytical, critical, capable of multi-layered communication, innovative, and transformative. The National Institute of Adult Continuing Education has historically framed employability as a social construct, marked by the shared responsibility of individuals, their shared adherence to company culture and behavior, and the public responsibility educational institutions have to ensure the employability of all students and citizens [2].

Meanwhile, as researchers argue over definitions, a report from the Council for Industry and Higher Education (CIHE) reports on survey results from industry partners. From the employers' perspective, employability is attributable to cognitive skills, generic competencies, technical ability, organizational awareness, and critical evaluation [3]. Robinson defines employability as "those basic skills necessary for getting, keeping, and doing well on a job" [4]. Other researchers define employability as skills that are teachable [5] and transferable [6]. Crucially, the literature immediately identifies gaps between researchers' and employers' definitions of 'employability' with employers valuing communication skills, analytical ability, and reflection on the part of employees, connecting these attributes with greater flexibility and organizational adaptation [7].

Perhaps employers are seeking future leaders as well. This would support the heavy recruiting of Citadel engineering graduates since leadership is a critical developmental pillar at the institution. Johnson and Hackman believe that leadership is a human condition based on the use of communication (verbal and nonverbal) to obtain organizational goals, while purposely displaying organizational values and behaviors through the use of symbols (words). Strong communication (professional) skills are clearly linked to being an effective leader [8].

Research shows that a gap between employer expectations and university beliefs about employability has been steadily growing for the last decade. Employers agree that communication and teamwork, so-called 'soft' skills, provided more professional and organizational value than hard skills such as technical expertise [8]. The value asymmetry is due to training capacity—organizations can train new employees on-site with necessary technical protocols, but few have time to train new recruits in developmental communication skills [9].

Employers' perspectives should inform curricular development, and there are real pedagogical, financial, and operational reasons for ensuring this alignment [10]. Internship experiences are regularly hailed as High Impact Practices (HIPs), providing students with opportunities for deepening their disciplinary understanding while also cross-training in their organizational understanding. Additionally, while there are many reasons for going to university, including a deep interest in the engineering discipline, people see education as a stepping stone to a good job, with 70% of students citing job opportunities as their primary motivation for education.

While engineering schools may believe they are aligning programs with industry needs, many employers think their views are ignored, with some noting that they have little contact with university program committees or opportunities to represent industry interests [7].

In sum, the two major players determining students' career success and employability, are both unaware of the others' perspectives and, at times, opposed. Engineering curricula focus on technical skill development, whereas communicative skill development may be included in a program, secondarily, and viewed in general as a low priority [11].

As a result, communication skills are typically developed as embedded course modules in the third or final program year [12]. Some students may begin their academic journey after serving in the military or working directly out of high school. This smaller student population may have different expectations of what industry values based on their previous leadership experience. However, for this study, this demographic was not separated and analyzed. Engineering curricula also 'own' their programs, allowing industry to provide input, but only through limited, controlled channels. Meanwhile, industry values communication and analytical skills over technical skills in new graduates because employers know they will use on-site training to supplement graduates' technical education. Figure 1 below shows the mutual dependency dynamic between Academia, Students, and Industry.

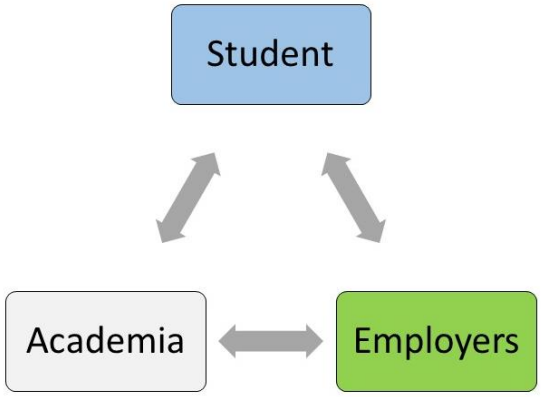

Figure 1: Input Dynamics among Academia, Students, and Employers

Surprisingly, industry also believes that their needs are often ignored by academia and view their participation on advisory boards and other bodies as insufficient in providing program guidance and growth. Finally, students view technical skills as more important to their success than communicative and analytical ones, which is likely a product of the way curricula are designed and the consequences that grades in particular courses have. Engineering student retention is typically not impacted by their communications course scores, but their grades in thermodynamics or calculus II, perhaps, may determine their retention. As a result, students are blind to what recruiters really want to see in new recruits, as is the university, because each stakeholder values something different. Figure 2 below summarizes this dynamic of mutual blindness.

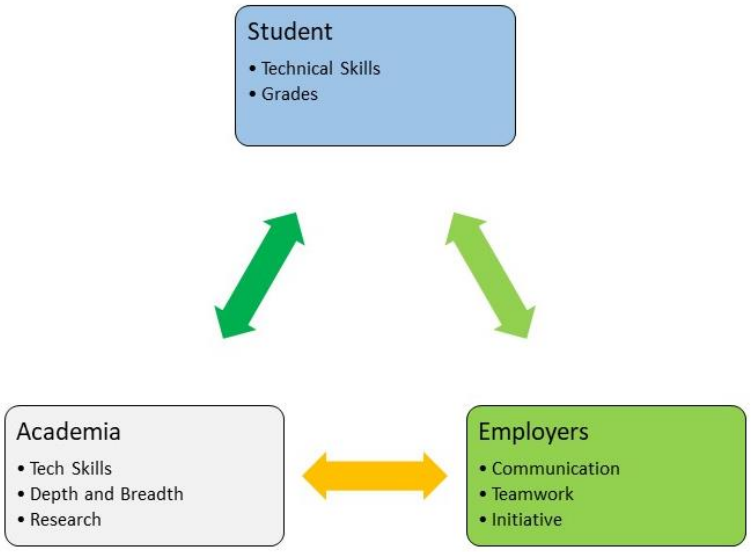

Figure 2: Valuing Different Employability Attributes

In this paper, employability views from students, industry, and faculty are captured by survey data. Some disagreement between faculty and students was captured, indicating an opportunity for alignment and student education. Industry strongly preferred verbal and written communication skills for new hires, and this may also represent an opportunity to encourage more engineering faculty to embed collaborative, communicative projects in otherwise fundamental engineering coursework.

Engineering Curriculum at The Citadel

Realizing the communications performance gap, ABET, and professional discipline-specific organizations like ASME and ASCE have all recommended and promoted the development of individual and collaborative communication skills for engineering students. A teaching approach that supports communication skill development is Project-Based Learning (PBL). PBL is an empirically-supported approach to integrative learning that develops students' communication skills as one of its byproducts. PBL is an instructional approach that relies on a student-centered classroom, and requires students to collaboratively solve undefined, open-ended problems and processes, and produce results that match clear, objective standards. Students are invited to reflect on their approach to problem-solving, identifying strengths, weaknesses, and the extent of their knowledge [13]. As supported by cognitive science findings, connecting known and new information supports deeper integration, learning, and memory retrieval, when reinforced by self-reflection. Additionally, studies in STEM-PBL show that this approach was associated with statistically significant performance gains among initially low-performing students and minorities, though the mechanisms behind these gains are still being investigated [14].

In an effort to address student communication skills gaps, the Mechanical Engineering program at The Citadel has scaffolded PBL opportunities throughout the curriculum and created communication assessment mechanisms that are continually refined by feedback from employers

and recent engineering graduates. From freshman to senior years, the Mechanical Engineering program has various PBL activities embedded in each year's course map. Students continually reinforce their teamwork and communication skills through these projects, presentations, and briefings. As their engineering work becomes more complicated and higher-order engineering analysis is required, students hone both technical and professional skills. This study represents a first effort at capturing perception differences between engineering students, employers, and engineering faculty as to what employability attributes are most important. This study also attempts to test the reproducibility of previous studies' findings that communication skills are the most important skill engineering students can develop to enhance their employability.

Communication Skills and Employability

Some researchers have attempted to bridge the employer-graduate employability gap by implementing a professionalization course that uses a Bloom's taxonomy-based employability skill matrix to develop employability skills in students [13]. Communication, Initiative, Teamwork, Planning, and Organization are all given dedicated modules within Kulkarni's model [13]. A closer look at Table 1 shows a series of skillsets having more in common with Project Management than many engineering-focused courses, with the exception of the Technology module.

In a previous study, researchers identified a contrast between students' expectations and employers' expectations regarding employability attributes [14]. However, both employers and students agreed that Communication was the most important skill set to develop [16]. Similarly, researchers studying student employability in East Asia, identify visual and written communication skills as the number one employability attribute, defining this as both literacy and communication in their employability matrix [13]. Table 1 provides an excerpted and revised version of this summary, where each employability skill is mapped to a descriptive attribute; recommended implementation; a level within Bloom's taxonomy of the cognitive domain, and finally, documentation of learning outcomes that increase in complexity as the curriculum advances.

Table 1: Employability Matrix and Bloom's Taxonomy [13]

Sr. No.	Employability Skills	Attribute in Employability Skills	Recommended Activities	Bloom's Level			
				1st year	2nd year	3rd year	Final year
1	Communication	Read and interpret technical reports correctly	Technical communication reports, technical graphs	B3	B4	B5	B6
		Generate technical reports on own	One sentence summary, social media materials	B4	B5	B6	B6

2	Team Work	Working with others	Calculation of personnel-power, management, resource allocation	B2	B4	B5	B6
3	Individual Work	Ability to work on diverse teams	Achieving high quality delivery, capacity, and multitasking	B3	B5	B6	B6
4	Initiative	Creative thinking, solution finding	Thinking differently about usage, applications, revising processes	B1	B2	B4	B6
5	Enterprise	Viewing problems from a broader perspective	Analysis of cause, effect, factors of a problem	B2	B3	B4	B6
6	Planning	Scheduling, deadlines	Time tables, elemental analysis, penalty calculations, emergency planning	B3	B4	B5	B6
7	Organizing	Resource usage, work allocation	Identifying capacity, efficiency, and effectiveness opportunities	B2	B4	B5	B6
8	Self-Management	Working without supervision, delegation	Internships, task assignment	B2	B3	B4	B6
9	Learning	Quick learner, adaptive	Sustainability concepts easily mastered, research, volunteering new ideas	B3	B4	B5	B6
10	Technology	Use of IT tools, innovative and invented products	Impact of technology management solutions	B2	B3	B5	B6

11	Application	Usage in daily life	Why, How, and When is it important?	B3	B5	B6	B6

While all of the reviewed research converges on the central take-away that communication and interpersonal skills are the most important employability attribute an engineering student can develop, it is less straightforward how to develop these skills within an engineering curriculum.

Methods

In a short survey, we solicited perceptions from three groups: industry, students, and faculty on the most important employability attributes for new engineering graduates. Over 60 Industry partners were surveyed during a recruitment event in Fall 2021 and are slated to be surveyed again in Fall 2022 to ensure the validity of results. Over 95 students were given a brief survey, requesting that they rank in order of importance a series of employability attributes collected from the literature. This survey also requested demographic information such as student rank and veteran or active duty status. Student respondents could remain anonymous. Simultaneously, a dozen engineering faculty were surveyed using a similar survey that requested faculty to rank the same attributes given to the students in order of their importance. Additional demographic questions for faculty included a question about prior industry or military experience, as well as the duration of that prior commitment. Appendix A provides the questions on the student perceptions of employability survey. The same questions were used to solicit responses from faculty and industry.

As this research moves forward, additional respondents will be added, particularly from industry and interested faculty.

Results

Industry

The graph in Figure 3 provides the majority of industry responses to a survey collected during an engineering recruitment event at The Citadel. Overwhelming feedback from over 60 industry respondents indicated that verbal and written communication were the areas identified as most important to them in potential hires. Respondents also indicated in free-text responses that communication was the area in which our students needed further development. In Figure 3, the x-axis identifies themes emergent in free text responses from industry recruiters; the y-axis identifies the percentage of respondents who mentioned those themes in their responses.

Reproducing earlier research findings, industry respondents cited (in free-text responses) spoken (64%) and written communication (22%) as the areas that are most in need of improvement for our engineering students, with industry leaders ranking engineering student resumes as a 7.4 on a scale of 1-10, with little variance (1.36).

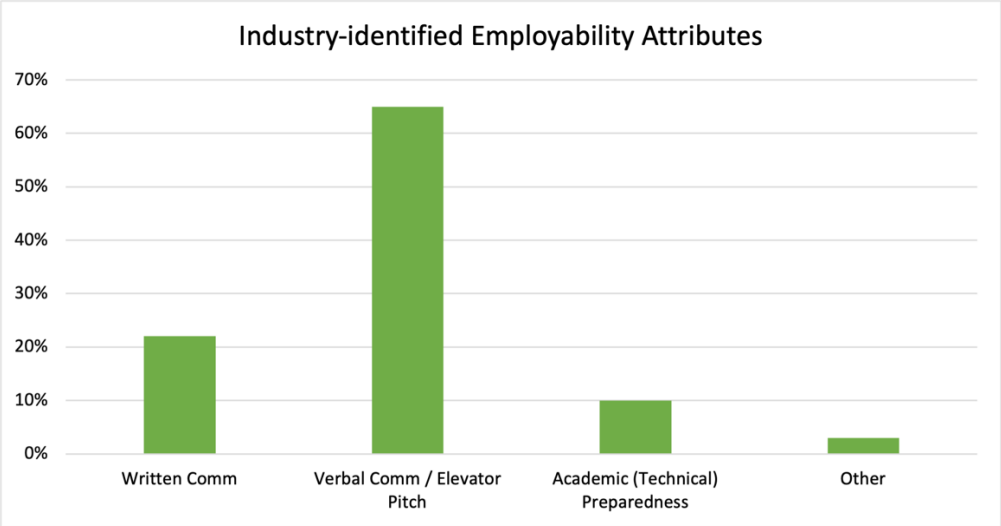

Figure 3: Industry-Identified Employability Attributes

Students' and Faculty's Perceptions

Students were asked to ordinally rank employability attributes like Teamwork, Verbal Communication, and Project Management from 1-10 for their early career preparation, with 1 being the least important to their successful employment, and 10 being the most important. This survey was provided to both students and faculty, and an example is given in Appendix A. Figure 4 below provides the ranked employability attributes that over 95 students and faculty identified as being most impactful to their career success, with Teamwork, Verbal Communication, and Project Management chosen as their top three. The x-axis in Figure 4 identifies themes that student and faculty respondents were asked to rank ordinally and the y-axis identifies the average ranking of a given response. Variance is low for these selections (2.4), but the authors continue to solicit additional student data to determine if student rank, veteran or active-duty status, or proximity to graduation influence selection. The x-axis identifies themes that student and faculty respondents were asked to rank ordinally and the y-axis identifies the average ranking of a given response. Students overwhelmingly chose Verbal Skills, Teamwork, and Project Management as the most important employability traits, likely reflecting their unique training at The Citadel. Rankings for Verbal skills and Teamwork were within a standard deviation (2.4), despite an appropriate sample size. More data needs to be collected to discover if these rankings will hold. For context, these students were mostly sophomores with little job experience. The researchers question whether student responses may change as a result of employment anxiety and proximity to graduation.

Results from the same attribute ranking survey show that engineering faculty identify Technical Analysis, Teamwork, and Technical Writing in their top three employability attributes. In alignment with previous research, engineering faculty members at The Citadel prioritize Technical Analysis. Like the students, faculty also selected Teamwork as their top secondary skill, and this result may reflect the unique nature of The Citadel, which builds collaborative, team-based leadership training into students' everyday life and academic projects. Though there is variance in the center rankings, faculty and student choices also converge on the least

important attributes, Networking and Programming, with little variance observed. The authors will continue gathering faculty perception data to determine if prior military or industry work experience or activity, as well as its duration, are predictive factors for faculty selections.

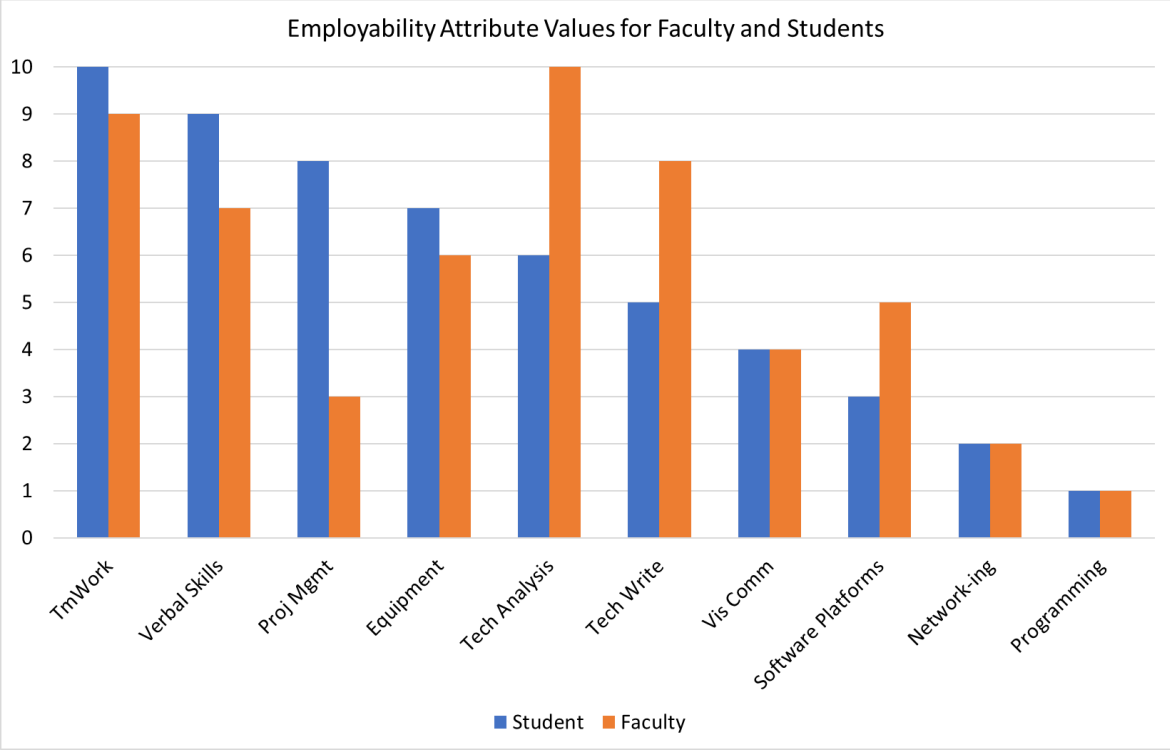

Figure 4: Comparison of Faculty and Student Attribute Values

Discussion

The Figure 4 Chart shows that technical skills and professional skills are key concerns for students. This survey instrument drills down on the concept of professional skills, breaking out project management, verbal, and written communication as separate attributes. Students and faculty were sensitive to these distinctions between kinds of communication, as shown in the chart. Ultimately, our results support previous research that industry is focused on a gap in so-called professional skills, and faculty tend to prioritize technical analysis. Meanwhile, student perceptions appear to be shifting, with most students identifying communication skills as their most important employability attribute. This shift from established research may be a result of the concerted initiatives The Citadel and others like it have created to partner with industry as a collaborator for accreditation, growth and retention [17]. As this is a longitudinal study, more survey data is needed before we can be certain that these results extend beyond the close industry-institutional partnerships enjoyed in the region.

The expansion of ABET requirements included a more articulated role for advisory boards, a move for which previous research called [18]. This move toward industry partnership was at least partly financially motivated, as a result of the recession and decreased state investment in higher education in the last decade [18, 19]. While advisory boards serve an important role in

guiding program development and refinement, there are many voices and partnerships that can provide more granular guidance as programs refine to meet industry needs. Beyond advisory boards, researchers have identified curricular and extra-curricular approaches to strengthening industry partnerships. Capstones, Internships/Co-Ops, Field Trips, and Networking Expos have all been embedded within the engineering curriculum at The Citadel. Table 2 below summarizes a selection of common and uncommon industry partnerships [19].

Table 2: Common and Uncommon Sources for Industry Partnerships [19]

Industry Partnerships Usually Considered	
Advisory Boards	Industry Executive Committees provide review and approval for ABET accreditation requirements (vision, mission, PEOs, POs, etc.), curriculum overview based on industry changes, and can be a fundraising arm. Staffed with industry leaders generally hiring current students.
Capstone Projects	Capstone projects are required by ABET. Industry generated capstone projects are usually more 'real-world' and enhance quality of program.
Internships/Co-Ops	Industry-sponsored hiring of students usually during the summer, but can be all year based on student course load and company requirements. Some companies only hire full time employees from Co-Ops (8-month full time internships)
Field Trips	Course or club trips to a construction, manufacturing, or design location to bring to life content in courses (visualization) or programs. Can be used to support retention.
Career Fairs	Centralized location to meet and discuss career opportunities within a company. Some are university-wide and some are discipline (i.e., engineering) only. Most charge a fee to participate to cover overhead and some discretionary support for student programs.
Industrial Partnerships Not Usually Cultivated	
Research	Teaching-focused schools have gifted faculty who can impact local industry through consulting that is research, analysis, or design support.
Career Center	Primary mission is career fairs, resume development, and search engines for internships and full time positions. These centers need to be a data center of when companies are advertising, especially those hiring our students.

Student Hiring	Increased industry relationships improve the likelihood of more students being hired at graduation.
Scholarships	Many scholarships are through endowments, but many industry contacts are willing to work with a school or program to support scholarships through term agreements. A unique arrangement is the student being an intern the following summer.
Surplus Equipment	Currently, more industrial equipment is smaller and similar in size to the lab equipment for teaching-focused programs. Robust industrial relationships increase the likelihood that surplus equipment will be offered to your program first.
E-Week Sponsors	E-week programs cannot grow without financial resources that industry sponsors can provide. Google sponsored a Trebuchet competition that has increased K-16 participation by 6 times. This also brings local students from multiple schools onto campus.
Mentors	Industrial mentors provide the direct link to the rewards at the end of the BS degree that can motivate a student to work through difficulties most experience initially in engineering.
Local Society Meeting Student Sponsors	Students must visualize their future to overcome difficulties. Attending societal meetings can provide the visualization of the group of people they would be working and socializing with, professional development, and mentoring and connections that can lead directly to internships and fulltime employment.
Recruiting	Industrial relationships increase the advertisement of workforce development programs directly increasing student numbers in programs.
Adjunct Professors	Many programs are forced to manage course loads using 25% adjunct faculty. The pool of technically and practice qualified adjunct faculty are working fulltime for the local industry. Long-term relationships with companies and one-on-one recruiting are key to gaining access and hiring these incredibly qualified personnel to assist in the teaching load.
Testimonials/Quotes	Student testimonials and company endorsements are critical to the local and regional status of an engineering program.
Equipment Access	Students and faculty may obtain access to specialized equipment (large 3D printers) that the school does not own.

Meanwhile, less common pathways to industry have been developed, resulting in increased exposure of engineering students to industry. These less-common pathways include research, Career Center tutoring, corporate-funded scholarships, surplus equipment donation, and Engineering Week event sponsors. All of these initiatives are cumulative and function together to build the web of relationship. Supporting studies have posited that today's students (so-called Millennials and Gen Z) require more focused, small-group mentoring opportunities to develop latent talents, professionalization [20], and professional skills. Notably, these small-group initiatives also support diversity initiatives. These focused mentoring efforts may look like volunteer opportunities; mandatory advising and industry mentoring; and club involvement with the Society of Women Engineers and the National Society of Black Engineers, among others. An increase in the number of contact points with candidate students, students, and graduates is directly related to enrollment and retention increases [21].

Going forward, program directors should be emboldened to make the most of the momentum that has been built with industry partnerships, innovating new opportunities for connection, participation, and growth, while investing both high- and low-profile approaches to building relationships, professionalization, and matriculation streams with industry partners so the right employability attributes are the key focus with alignment between industry, students, and faculty. A more closely partnered approach between faculty and industry fosters opportunities for industry to serve as engineering communication role models for students. These formal and informal opportunities also ensure that employers' expectations and perceptions occupy an important role in determining the skills that need to be reinforced in the engineering curriculum.

References

[1] R. Holden and S. Jameson, S. "Employing graduates in SMEs: Towards a research agenda," *Journal of Small Business and Enterprise Development*, 2002.

[2] H. Gilbert and H. Prew, "A Passion for Learning: Celebrating 80 Years of NIACE Support for Adult Learning." National Institute of Adult Continuing Education, 21 De Montfort Street, Leicester LE11 7GE, United Kingdom, 2001. Web site: http://www.niace.org.uk.

[3] B. Kubler and P. Forbes, "Student Employability Profiles: A Guide for Employers, Degrees of Skill," *Council for Industry and Higher Education*, 2005.

[4] J. P. Robinson, "What Are employability skills? Community workforce development specialist," *Alabama Cooperative Extension System*, *1*(3), 2005.

[5] L. D. Pool and P. Sewell, "The key to employability: developing a practical model of graduate employability," *Education + Training*, 2007.

[6] M. Yorke, *Employability in higher education: what it is-what it is not* (Vol. 1). York: Higher Education Academy, 2006.

[7] K. Lowden, S. Hall, D. Elliot, and J. Lewin, "Employers' perceptions of the employability skills of new graduates," *London: Edge Foundation*, 2011.

[8] C. E. Johnson and M. Z. Hackman, *Leadership, A Communication Perspective*. 7th Edition. Long Grove, IL: Waveland Press, Inc., 2018.

[9] W. Archer and J. Davison, "Graduate employability," *The council for industry and Higher Education*, 1-20, 2008.

[10] A. G. Eggleston and R. J. Rabb, "Returning to an Industry-informed Technical Writing and Communication Course Design," Paper presented at *2019 ASEE Annual Conference & Exposition*, Tampa, Florida, June 2019. 10.18260/1-2—33246.

[11] A. G. Eggleston and R. J. Rabb, "Survey and Best Practice Identification for Course Development and Integration of Technical Communication for Engineers," *Technology Interface International Journal* (Vol 22), 2022.

[12] A. G. Eggleston and R. J. Rabb, "Assessing Department of Defense Demand for Veterans During and After Degree Completion," Paper presented at *2020 ASEE Virtual Annual Conference*, Content Access, Virtual Online, June 2020. 10.18260/1-2—34174.

[13] V. A. Kulkarni, A. K. Bewoor, P. Malathi, and B. S. Balapgol, "Employability skill matrix for engineering graduates of tier-II institutes," *Journal of Engineering Education Transformations*, *30*(3), 71-76, 2017.

[14] N. D. Nguyen, Y. Yoshinari, and M. Shigeji, "University education and employment in Japan: Students' perceptions on employment attributes and implications for university education," *Quality Assurance in Education*, 2005.

[15] S. K. Pun, "Visual Literacy for Engineering Undergraduates," *International Journal of Education and Information Technologies*, (1), 9-16, 2007.

[16] J. Norback and J. Hardin, "Integrating Workforce Communication into Senior Design," *Professional Communication, IEEE Transactions*, vol. 48, no. 4, pp. 413–426, 2005.

[17] A. C. Estes, R. W. Welch, S. J. Ressler, "Program Assessment: A Structured, Systematic, Sustainable Example for Civil Engineers", Volume 3, *Assessment in Engineering Programs: Best Evolving Practices*, Chapter 7, Association of Institutional Research, 2008.

[18] R. W. Welch, R. J. Rabb, and K. C. Bower, "Industry Partnerships Assist Programs for Accreditation," Paper presented at *2018 ASEE Annual Conference & Exposition*, Salt Lake City, Utah, June 2018. 10.18260/1-2—30657.

[19] M. Mitchell, M. Leachman, and K. Masterson. "A Lost Decade in Higher Education Funding State Cuts Have Driven up Tuition and Reduced Quality." *Center on Budget and Policy Priorities*, 2017. www.cpbb.org.

[20] R. J. Rabb, R. W. Welch, W. J. Davis, D. D. Ragan, and J. Geathers, “Small Mentoring Efforts that Make a Big Difference for Retention,” Paper presented at *2019 ASEE Annual Conference & Exposition*, Tampa, Florida, June 2019. 10.18260/1-2—33270

[21] R. W. Welch, K. C. Bower, R. J. Rabb, and A. K. Martin, “Keeping a Prospect on the Line and Then in the Boat: Recruitment and Retention Efforts that Make a Difference,” Paper presented at *2018 ASEE Annual Conference & Exposition*, Salt Lake City, Utah, June 2018. 10.18260/1-2—30745

Appendix A. Student Perceptions of Employability Survey

1. Year? Senior Junior Sophomore Freshman

2. Veteran or Active Duty status? _____ Yes _____No

3. When you approach a potential employer or career contact—what do you worry about most?

4. When you are working for an employer (internship or permanent position)—what do you worry about most?

5. Rank the relative importance of the following skills in ensuring your success in your next job, with '1' being most important and '10' being least important. No fractions or repeat numbers allowed.

___ Programming skills (C++, Java, Perl, Python, SQL, etc.)

___ Teamwork (working with others, conflict resolution, de-escalation, leadership development)

___ Technical Writing (project documentation, project reports, specs and inventory requests, email)

___ Verbal Skills (phone calls, voicemail, recording, contacting new clients, face-to-face conversation)

___ Technical Analysis (Engineering, Computer, Life Sciences)

___ Visual Communication (presentations, videos, expos)

___ Project Management (work scheduling, resource allocation, deadlines)

___ Software Platforms (CAD, Excel spreadsheets, PSpice, MatLab)

___ Equipment (knowledge of equipment, maintenance, and measurement)

___ Networking (LinkedIn, meeting clients, interacting with potential customers at events)