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What Employers Look for in New Engineering Graduates

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Abstract

This paper looks at what many employers look for in new engineering graduates. Some of this is contained in ABET requirements such as student outcomes for what students should know or be able to do at the time they graduate and in program outcomes for what students should know or be able to do several years after graduation [1]. This paper looks at more specific details, many of which are not contained in ABET requirements, that should be valuable for faculty, engineering programs, and students. There is often a significant gap between academic preparation and full time employment in industry [2]. Properly prepared students benefit the students themselves because they are more likely to get the job they want, the engineering programs they came from because they can establish reputations for producing well-prepared students, and the employers that hire the students.

Introduction

Many companies today assume a student's technical competence as indicated by a good GPA, especially in their engineering major. However, technical skills are not the subject of this paper. One of the authors has a manager who warns against hiring students with too high a GPA as their personal experience is that those students often do not have good social skills.

Many companies no longer require further proof of technical competence during job interviews and choose to focus instead on non-technical skills. The focus has shifted to what are often called professional skills which can be defined as "skills essential to thrive in a work setting but are historically not included in engineering or engineering technology coursework" [3]. A National Academy of Engineering report notes the growing demand for engineering graduates with professional skills in addition to technical skills [4].

Professional skills include, for example, communication skills, emotional intelligence, teamwork and multidisciplinary work, curiosity and a persistent desire for continuous learning, project management (supervising, planning, scheduling, budgeting), critical thinking, self-drive and motivation, cultural awareness in a broad sense (nationality, ethnicity, linguistic, sexual orientation) and high ethical standards, integrity, and global, social, intellectual and technological responsibility [3]. The focus of this paper is on some of those professional skills.

Below are some examples of things that many employers look for in new engineering graduates:

- Leadership examples in school, at home, at work, in outside organizations, etc.
- Previous relevant work experience, preferably internships, co-ops, and research projects with professors.
- Can cogently discuss major projects, especially their capstone.
- Passion / interest in the company and position.
- That students did their homework on the company by extensively searching their website; note that the focus should be on positive aspects and not any negative issues that may be in the news.

- Related to doing their homework on a company is being prepared with some good questions to ask to show they did their homework and are interested in the company.
- Good eye contact since the stereotype of engineers is that they are introverted and not good oral communicators.
- Good listening skills.
- Humility (acknowledging shortcomings, giving credit to others, etc.); this is particularly critical at many companies where humility is part of the company's DNA – coming off as arrogant is a sure way not to get hired.
- Hands-on abilities (e.g., do they work on their own car, fix their own computer, etc.); while it is easier than ever to determine if a design will work based solely on computer simulations and CAD software, these are still not flawless and software often does not always indicate whether all of the parts can actually be reasonably made.
- Relevant hobbies outside of school such as building model airplanes, working on a farm, restoring old cars, etc.; for example, being a pilot is of particular interest to companies in the aerospace industry.
- Fluency in a foreign language of interest to the company; for example, a country that has operations in South America may particularly appreciate engineers that can speak Spanish and/or Portuguese.
- Have at least a realistic plan of where they want to be in 5 and 10 years, especially if they plan to stay on the technical side or want to move into management; this does not mean a candidate is locked into a particular career path, but they at least have a plan (which can change based on circumstances).
- It may not be "cool" to go to your professor for help, but it is a very good idea to meet up with coworkers/management.
- Students are not typically expected to spend time in other departments to learn what they do, but in the professional world it is imperative that engineers know what other groups are doing around them.
- How to deliver bad news either to a superior or to a direct report because most have never had to do this before.
- How to handle a project crisis because most have never had to do this before.
- Asking meaningful questions, seeking wisdom and knowledge from coworkers or superiors.

This paper will consider the following specific professional skills: interviewing, project management, critical thinking, teamwork, communication, and lifelong learning. In a survey of 827 Canadian engineering students, some of the top ten weaknesses of the Canadian engineering curricula included communication skills, an ability to work with others, and project management [5]. A survey of engineering seniors produced an interesting result: while those students think that both communication and teamwork are important, they may not actually understand how those skills are applied in practice [6]. Therefore, the main thrust of this paper is how engineering programs can better prepare their graduates for the workplace, rather than what organizations can do to more effectively teach professional skills to new graduates after they are hired. Note that no attempt is made here to be comprehensive to try to discuss all possible

professional skills of interest to employers. Those selected here are of particular interest to the authors based on their experiences in industry.

Interviewing Skills

Interviewing skills are critical to help candidates get the job they desire. The best applicants are on time, respectful, and excited. It is perfectly fine to be nervous and to take time to answer. The best applicants do not spend the whole time talking trying to impress the interviewer. They take a moment, compose themselves and organize their thoughts, and then answer specifically and succinctly. Interestingly, those applicants usually get to talk more anyway because the interviewer has time for follow up questions which usually bring even more insight than their original answer. Some schools offer interviewer training which can be invaluable for preparing students.

A particularly important characteristic that many interviewers are looking for is passion for the job, the company, and the industry. One of the authors recommended a top student who did not end up getting the job. When asked what happened, the student said he tried so hard not to be nervous that he came off in the interview as uninterested. That is almost a guaranteed method for not getting the job. Interviewees can make some (hopefully small) mistakes in an interview which may not even be noticed if they are genuinely passionate and excited about the position.

The best applicants are flexible, willing to take whatever role in whatever location to begin their career. They do not spend as much time talking about what they believe but rather on what they have seen or done. It is easy to tell pretty quickly who has actually done the work and who has not. Previous technical experience is always great, but for those who are young or have not had those opportunities, they can use personal experiences: sports teams, Boy Scouts, volunteering, competitions, etc. The best answers are from those who speak about their specific responsibilities, showing they didn't just attend but truly participated.

Many companies now use scenario questions to determine how a candidate might fit into the organization. One type of scenario question is referred to as SBO (situation-behavior-outcome). In many cases, failures can reveal more about the candidate than successes. The focus is not on the failure but what the candidate learned from the experience and what changes they made as a result. In many cases, people learn more from their failures than from their successes. Earnest attempts that failed show the candidate cared and pursued a path with an unexpected outcome. They usually show a higher degree of humility and coachability which are extremely valuable and hard to find. Higher marks are given for candidates who came up with their own idea to solve a problem, not just a specified prompt, because it shows creativity and initiative.

Memorable candidates are able to carry on a comfortable and light conversation, and bring their own questions to the interview. Tactful jokes are just fine and encouraged! One of the author’s three favorite interviews of all time have some fun stories:

1. One male student was previously a rodeo cowboy for the school studying nursing. He found out that was not his passion and switched to petroleum engineering which he loved. Since he was older and it was hard to find work, he worked as a mechanic at a gas

station, which proved invaluable because he learned a lot about the end product of oil and gas and general pipeline maintenance. After the first day of a career fair, he went back to his room, and typed up a custom cover letter and give it to the author the next day saying in more detail how much he appreciated the conversation and was convinced the author's company was the place he wanted to be. The author is still friends with him to this day.

2. Another male candidate had a previous degree and career in banking, but found that life draining. He went to a life coach who told him to go back to school and so he did in order to pursue mechanical engineering. After two years he started to apply for internships, but the 2014-2015 oil and gas downturn in pricing cost him his internship. He decided to turn his hobby of woodwork into a source of income that summer. He arranged with local carpenters to rent their space and tools and started his own company where he was able to show his products at local fairs. He was then able to keep doing it on the side when the school year started up again, and actually gave me his wooden business card at our interview. It was very impressive to say the least.
3. The last one was another male candidate who was a big man and had hair down to his waist, was on the track and field team for his college, and previously lived in other countries as a missionary kid. Because of these varied experiences he was able to gather perspective on life and solidify his values. With that said, he did not have the highest grades, but he had amazing character and work ethic which came through in his responses, respectful demeanor, and overall humility. He had great relationships with his professors which meant he was actively trying to work on his grades; however, the academic setting was not where he shined. Since he began working, he has definitely come into his own.

Project Management Skills

Project management and management of general tasks is important in nearly all engineering positions. The ASEE skills gap survey found that project management was one of the skills that students felt least prepared for after completing their undergraduate degrees [3]. In a survey of recent engineering graduates, two-thirds did not realize how much of their work included project management [6]. Interestingly, many did not consider project management to be "real engineering".

In a survey of 41 undergraduate and graduate engineering students, 93% believe that good project management skills are very important for the engineering profession [7]. However, those same respondents rated the quality of their education in project management was not very high. This is not surprising as the only real opportunity for most students to use project management is in their capstone. They generally receive very little formal training in how to manage projects.

One of the authors likes to structure their projects to have six things they're responsible for at any given time. One number one that is always the most important thing to stay on top of, two number twos where they probably spend most of their time working, and three number threes where they provide support and assistance but are usually always being worked on. They want to always know where they stand on a project and ensure they add value to conversations and can jump right onto something when needed. They believe this is probably the most beneficial thing

to help them manage their work. They note the importance of persistence when needing answers to help make progress on their number one and twos.

Good teamwork (discussed further below) and due diligence in being prepared for meetings has been very crucial as well in project management. Also, good relationships in the office where it is more than just about work, this really helps understand each other, when help may be needed or to understand where their strengths may be able to assist.

There is a significant difference between study groups/group projects in school and how to efficiently run a meeting in an organization with multiple audiences or groups present:

- Setting agendas and having specific topics (especially important for upper management)
- Coming prepared and not just expecting the others to provide the content
- Follow up emails with notes/actions

Effective project managers learn how to get their projects done on time and within budget, both of which are critical in most organizations.

Critical Thinking Skills

An important skill engineering students need to learn is critical thinking [8]. Many times, industrial problems have multiple potential answers, so critical thinking is required to determine the best solution [8]. Brookfield (2012) defined critical thinking as "identifying assumptions, testing their validity, seeing things from different viewpoints, and taking informed action" [9]. Halpern [10, p. 450] defined critical thinking as "the deliberate use of skills and strategies that increase the probability of a desired outcome" which is specifically used in problem solving. In this case, the desired outcome is a correct solution. Halpern argued students can become better critical thinkers through appropriate instruction and that enhancing students' critical thinking ability is both challenging and rewarding for instructors. Snyder and Snyder [11, p. 90) wrote, "Students who are able to think critically are able to solve problems effectively."

Although critical thinking is not specifically identified in the seven ABET student outcomes, it is implied in some of them. Formulating problems and applying engineering design of necessity should include critical thinking. While in school, students are given specific projects, where in the professional world they may have to create solutions from scratch. Real world problems do not have a single answer, unlike most of the problems they solved while in school where there are single answers to homework and or exam problems. Unfortunately, in the ASEE skills survey, nearly half of the students surveyed did not feel prepared at all for the skill of critical thinking [3].

Critical thinking is a key metacognitive activity that should desirably occur during learning and problem solving [12]. Critical thinking and judgment are required for engineering professionals to solve workplace problems [13]. This includes the ability to critically evaluate solutions. Merely generating an answer does not guarantee the result is credible and appropriate. In most university engineering courses, problems typically have a single correct answer that a student's answer can be compared against. Many real-world engineering problems are not that simple and often don't have a single correct answer. Students must develop the ability to critically assess

their solutions for credibility since they will not be able to compare the results of solving real-world problems against an answer in the back of a textbook.

Teamwork

Teamwork, sometimes referred to as collaboration, is critical in most engineering positions because problems are larger and more complex than can be handled by single individuals. Lahdiji makes a relevant observation, "Today's engineers are becoming an integrator, and a coordinator of information, technology, and people" [14]. This clearly requires teamwork. A survey of Malaysian employers of engineers from a private university ranked teamwork as the number one employability skill [15]. A different survey of Malaysian employers showed they have high expectations that engineering graduates will work well as leaders and as members of teams [16]. A survey of 420 engineers and engineering managers in the aerospace industry showed that an ability to function on multi-disciplinary teams ranked highly as an industry expectation [17]. In a survey of Australian employers, teamwork was ranked in the top five out of 23 desirable attributes for engineering graduates [18]. A large survey of 2115 engineering alumni from a large Midwestern university found that participants ranked teamwork as the highest of the old ABET a-k student outcomes [19]. A recent survey of 94 employers by the University of North Carolina at Charlotte found that the number one desired skill for new engineering graduates was an ability to work effectively in teams.

An increasing number of projects are cross-disciplinary. Communication is further complicated by multiple time zones, cultures, and sometimes even languages. Idrus et al. believe that the ability to communicate in English is an essential skill for engineering graduates [20]. Engineers must learn to work in teams; however, they do not get a lot of practice doing that as undergraduates, except for labs and capstone projects. Part of the reason for this is that many engineering courses are theory-based where problems have a single correct answer, with faculty trying to assess the performance of individual students. In most cases, all students on a team receive the same grade regardless of the amount they contributed to the project. This has some obvious potential problems where some students may do most of the work, sometimes because they don't trust their teammates and sometimes because their teammates do not adequately contribute. Back and Sanders write, "engineers at all levels must be able and willing to function in a team environment, and to accept that the team, not the individual, will succeed or fail" [21].

Learning how to work effectively in teams is a skill that is not as straightforward as solving an engineering problem. In some cases, it is a skill that is learned and refined over an entire career because there are many dynamics at work. If not properly learned, this could have a deleterious effect on an engineer's career. If someone is brilliant but cannot communicate their ideas to their teammates, then they are not likely to be very effective as an engineer. People with expertise in different disciplines may not speak the same technical language. Teammates may be from very different generations and ethnic backgrounds. Gender and personality types can also impact how teams function. Every team is different and the projects themselves also influence team dynamics. Projects that are basically variations of past projects typically go more smoothly than new projects where there is little past experience (often referred to in industry as "go-bys") to rely on. A further complication is that in many cases teammates have different supervisors so even the supervisors have to be in agreement to make sure projects are properly managed.

Communication Skills

Communication skills are important in most professions, but they are particularly important in most engineering jobs. A survey of 208 engineering alumni specifically targeted communications and found that those responding spend nearly two-thirds of their time in some form of communications, which the researchers found to be astonishing [22]. The assumption was that engineers spend most of their time doing calculations and solving technical problems. The respondents clearly indicated that technical communication must be an integral part of the engineering curriculum. Beer and McMurrey write, "Poor communication skill is the Achilles' heel of many engineers, both young and experienced – and it can even be a career showstopper" [23]. ABET Student Outcome three is "an ability to communicate effectively with a range of audiences" [1]. The Malaysian Ministry of Education defines communicating effectively as "the ability to present ideas with confident (sic) and effective (sic) through aural, oral and written modes, not only with engineers but also with the community at large" [24].

In a survey of 57 recent engineering graduates, nearly two-thirds of them said they used communication skills on the job, which was the highest percentage of the professional skills queried [6]. In that same survey, the importance of communication skills was found to increase when comparing responses for the same participants between their junior year in college and after four years in the workplace. In a survey of 41 undergraduate and graduate engineering students, 100% believe that good communication skills are very important for the engineering profession, which was ranked higher than hard sciences and engineering science fundamentals [7]. A large survey of 2115 engineering alumni from a large Midwestern university found that participants ranked communication as the fourth highest of the old ABET a-k student outcomes, although it was not far behind the three ranked slightly higher [19]. A recent survey of 94 employers by the University of North Carolina at Charlotte found that over 70% believe the ability to communicate through speaking/presentation and through writing are very important for new engineering graduates.

Sageev and Romanowski state the problem well, "although today's fast-paced, competitive workplace requires engineers to convey technical information quickly to diverse audiences, the overwhelming evidence shows that graduating engineers are inadequately equipped to meet this need" [22]. A survey of 42 engineers working in industry found that effective communication skills are particularly lacking in new engineering graduates [21]. In a survey of Australian employers, oral and written communication were ranked in the top five out of 23 desirable attributes for engineering graduates [18]. In a survey of 73 top-ranked U.S. and Canadian engineering schools regarding improving undergraduate engineering communication skills, the following are some key results [25]:

- 50% of U.S. schools and 80% of Canadian schools require a technical communication course,
- About 33% of the schools utilize some form of integrated communication instruction,
- About 33% offer an elective course in communication, and
- 10 schools have created engineering communication centers to provide individualized coaching and feedback to students.

In many engineering jobs, engineers will spend more time communicating than calculating [26]. Communication skills include both written and verbal communications. Engineering students

typically do not get as much practice with those skills because most of their education involves individual problem solving. While that is important, especially for developing technical skills, communication skills are also very important, particularly since many engineering calculations in the workplace are computerized and are designed to be done as quickly as possible. An additional challenge is that many engineers must communicate with a wide range of audiences ranging from operators and those working on the shop floor, to clients and colleagues, up to senior level management. Something learned as a new engineer is that if you want to get help from an operator or technician, a box of donuts goes a long way. It shows respect and a desire to work with another person. Another challenge is that engineers may be communicating with colleagues in many other disciplines such as accounting, purchasing, marketing, and human resources who often think differently than engineers. To be an effective employee, engineers must learn to communicate with all stakeholders.

Email is an important communication method with both colleagues and customers. However, for a generation raised on texting and Twitter, new graduates have to be aware that email is considered formal communication so colloquial abbreviations should be avoided. There is little excuse today for spelling and grammatical mistakes as most software packages flag them and some even automatically correct them, although the user needs to make sure the correction is what is actually meant – occasionally the correction is wrong. Keeping stakeholders up to date is especially important for new graduates to make sure things are on track and that there will not be any unexpected surprises that could be costly and potentially embarrassing.

Another part of communication is asking for help when it is needed, regardless of the level of the person. The most common source for help will typically be colleagues and supervisors, but it could include shop personnel and sometimes even customers. Rather than assume something that may be wrong, new engineering graduates need to make sure any assumptions they make are correct. It is expected that new graduates will not have all the answers, so that is particularly the time to ask lots of questions. Finding the subject matter experts (SMEs) on various types of processes and equipment pays dividends. Some companies use software such as Everlearn to identify the knowledge that resides within the company. This is particularly beneficial in large companies with many locations and many sister companies as it may be difficult and time-consuming to find an SME for a highly specialized subject area simply by networking.

Lifelong Learning

For many new engineering graduates, it is a revelation to find out that not only are they not done learning when they graduate, but that they have only just started learning. There is no way a university engineering program could possibly teach students everything they might need to know about every technology in every industry. As it is, the curriculum is already packed with a wide range of foundational courses that provide the theory behind many processes and technologies. The primary function of an engineering degree is to prepare students so they can learn the specifics of the products and technologies their employer offers. In some cases, this may take a lifetime. In other cases, such as in electronics, technologies change so quickly that failure to keep up with the latest developments may mean getting left behind and jeopardizing future employment prospects. Because of rapid changes in technology, lifelong learning is a "lifelong proposition" [4]. ABET student outcome seven is: "an ability to acquire and apply new knowledge as needed, using appropriate learning strategies" [1]. This is one of the more

challenging outcomes to measure because it is more subjective than most of the other outcomes, but it is clearly very important.

It is the opinion of the authors that universities could do a better job of preparing students for the realities of industry, especially the need to continuously learn. Part of the problem is that too few faculty members have practical industrial experience that they can draw from to inform their students. This problem could at least be partially addressed by having more industrial guest speakers early in the curriculum, including presentations to freshmen and sophomores, so students can get more exposure to what they may see when they start working. Internships and co-ops are an excellent way for students to experience industry for themselves. While helping professors with their research may provide valuable experience, it is not the same as working in industry if that is where a student desires to work. One of the requirements for maintaining a professional engineering license is a minimum amount of ongoing training and education. Further emphasis on continual learning in the workplace would better prepare students so they will not be surprised that they must continually learn throughout their careers. A survey of recent engineering graduates found that the vast majority of them learned about specific processes and equipment in the workplace, rather than in school [6].

There are many ways engineers learn in the workplace, ranging from formal courses to informal mentoring by more experienced engineers. Every industry has trade magazines that are useful for keeping up with new technologies and trends. Technical journals provide in-depth knowledge on very specific and often cutting-edge subjects. New graduates should be strongly encouraged to join appropriate technical societies which have magazines to keep members up to date on developments within a given discipline. Those societies also sponsor conferences that are very useful for learning about new products and services and about new developments presented through technical papers and presentations. There are also many specific industry and technology conferences that engineers may consider attending. Most organizations financially support this type of ongoing education so in some cases it is simply a matter of the new engineer working with their supervisor to determine which trade magazines, journals, and conferences are most relevant for their company and industry. However, it is highly recommended that individual engineers take responsibility for their own learning and development. While supervisors should be very helpful in suggesting useful training and education, it is ultimately incumbent upon each engineer to make sure they continually learn.

Recommendations

University engineering programs do a good job of training students how to solve technical problems which is an important skill needed in the workplace. However, those programs could do a better job training students in professional skills as discussed here. Ideally, industry wants new graduates who have both strong technical and professional skills [27]. Kövesi and P. Csizmadia write, “The lack of non-technical competencies remains the main concern of industrial companies when employing young, inexperienced engineers” [27]. Perhaps not surprisingly, some believe engineering graduates with strong non-technical skills have an advantage in the job market compared to those with weak non-technical skills [28].

Part of the problem is that there are not the same opportunities to use some of the skills in school compared to in the workplace. For example, project management, critical thinking, and

teamwork are only predominantly used in capstone projects. In many other courses, the focus is on acquiring knowledge that can be used in, for example, capstone projects, and not on how to effectively work on large, multi-disciplinary projects like the types in industry. Another part of the problem is that many students do not view professional skills to be as important as technical skills [6]. In some cases, students don't associate those professional skills with "real engineering." In some papers, professional skills are referred to as "non-technical competencies" or "soft skills" [27] which might suggest they are less important than technical competencies and so-called hard skills. Therefore, those students tend to spend less time and energy developing those skills while in school. However, they find out quickly that professional skills are very important if not critical in industry.

At a minimum, engineering programs can improve students' awareness of the importance of professional skills. It would be even better if they helped students develop those skills while still in school. One way to do that is to have more open-ended projects for teams of students, which would also better prepare students for their capstone projects. Another suggestion is for engineering programs to offer special courses in world cultures and languages to help students develop teamwork skills when they work on teams with members from other countries [26]. Improved professional skills would produce more effective graduates and help make new graduates more effective more quickly in the workplace. The graduates would have higher employability which may be defined as "having the capability to gain initial employment, maintain employment and obtain new employment if required" [15]. This would positively reflect on programs that produce graduates with stronger professional skills.

The University of Tennessee has created an innovative minor in Engineering Communication designed to work in conjunction with the Freshman Engineering Program [29]. It is designed specifically to address two of the professional skills considered here: communication and teamwork. It also addresses leadership. In this program, the College of Engineering is partnering with the College of Education's Counseling, Deafness, and Human Services Department. The program consists of five courses, two of which can be used to meet the humanities requirement and three specifically credited towards the minor. These types of innovative programs are needed to meet the professional skills needs of both graduates and the employers they will work for.

As with most challenging problems, there are no easy, simple answers to teaching professional skills to engineering students. Innovation and experimentation are needed to find what does and does not work. A further difficulty is getting feedback from students and employers after new graduates enter the workplace. Longitudinal studies to show the professional skills of incoming freshmen compared to those who have worked in industry for a few years would provide invaluable information on what skills need further improvement.

References

[1] ABET Engineering Accreditation Commission, 2022-2023 Criteria for Accrediting Engineering Programs, ABET, Baltimore, Maryland, 2022; https://www.abet.org/wp-content/uploads/2022/01/2022-23-EAC-Criteria.pdf

[2] C. Baukal, M. Vaccari, T. DeAgostino, C. Stokeld, and C. Baukal, "Preparing Mechanical Engineering Students for Industry," in C. Baukal (Ed.), *Mechanical Engineering Education Handbook*, Nova Science, New York, 2020.

[3] American Society for Engineering Education. (2020). ASEE Corporate Member Council Survey for Skills Gaps in Recent Engineering Graduates

[4] National Academy of Engineering 2018. *Understanding the Educational and Career Pathways of Engineers*. Washington, DC: The National Academies Press. https://doi.org/10.17226/25284.

[5] E. May and D. Strong. "Is engineering education delivering what industry requires," Proceedings of the Canadian Engineering Education Association (CEEA), pp. 204-212, 2006.

[6] S. Brunhaver, R. Korte, S. Barley, and S. Sheppard, "Bridging the Gaps Between Engineering Education and Practice," in R. Freeman and H. Salzman (eds.), U.S. *Engineering in a Global Economy*, University of Chicago Press, 2018.

[7] A. Agrawal and S. Harrington-Hurd, "Preparing next generation graduates for a global engineering workforce: Insights from tomorrow's engineers," *Journal of Engineering Education Transformations*, 29(4), 5-12, 2016.

[8] C. Baukal, "Promoting Critical Reflection During Problem Solving: Assessing Solution Credibility," presented at the American Society for Engineering Education (ASEE) Zone III Meeting 2015, Springfield, MO, September 24, 2015.

[9] S. Brookfield, *Teaching for Critical Thinkin*g, Jossey-Bass, San Francisco, 2012.

[10] D. Halpern, "Critical Thinking for Transfer Across Domains," *American Psychologist*, 53(4), 449-455, 1998.

[11] L. Snyder and M. Snyder, Teaching Critical Thinking and Problem Solving Skills, *Delta Pi Epsilon Journal*, *L*(2), 90-99, 1995

[12] C. Masui and E. De Corte, Enhancing learning and problem solving skills: orienting and self-judging, two powerful and trainable learning tools, *Learning and Instruction*, 9(6), 517-542, 1999.

[13] R. Stevens, A. Johri, and K. O'Connor, Professional Engineering Work, Chapter 7 in *Cambridge Handbook of Engineering Education Research*, edited by A. Johri and B.M. Olds, Cambridge University Press, New York, 2014.

[14] B. Lahidji, "Competencies in Manufacturing Engineering Technology programs from employer's point of view," Proceedings of the 2000 ASEE Annual Conference, St. Louis, June 18, 2000, pp. 5.155.1 - 5.155.7, 2000.

[15] H. Harun, R. Salleh, M. Baharom, and M. Memom, "Employability Skills and Attributes of Engineering and Technology Graduates from Employers' Perspective: Important vs. Satisfaction," *Global Business and Management Research*, 9(1s), 572-580, 2017.

[16] A. Zaharim, Y. Yusoff, M. Omar, A. Mohamed, and N. Muhamad, "Employers' Perceptions and Expectation (sic) toward Engineering Graduates: A Study Case," Proceedings of the 6th WSEAS International Conference on Engineering Education, pp. 23-29, 2009.

[17] J. Lang, S. Cruse, F. McVey, and J. McMasters, "Industry Expectations of New Engineers: A Survey to Assist Curriculum Designers," *Journal of Engineering Education* 88(1), 43-51, 1999.
[18] C. Nair, A. Patil, and P. Mertova, "Re-engineering graduate skills – a case study," *European Journal of Engineering Education* 34(2), 131-139, 2009.
[19] H. Passow, "Which ABET Competencies Do Engineering Graduates Find Most Important in their Work?," *Journal of Engineering Education* 101(1), 95-118, 2012.
[20] H. Idrus, R. Salleh, and M. Abdullah, "Oral Communication Ability in English: An Essential Skill for Engineering Graduates," *Asia Pacific Journal of Educators and Education*, 26(1), 107-123, 2011.
[21] W. Back and S. Sanders, "Industry expectations for engineering graduates," *Engineering, Construction and Architectural Management*, 5(2), 137-143, 1998.
[22] P. Sageev and C. Romanowski, "A Message from Recent Engineering Graduates in the Workplace: Results of a Survey on Technical Communication Skills," *Journal of Engineering Education* 90(4), 685-693, 2001.
[23] D. Beer and D. McMurrey, *A Guide to Writing as an Engineer*, John Wiley & Sons, New York, 2019.
[24] A. Azmi, Y. Kamin, and M. Noordin, "Competencies of Engineering Graduates: What are the Employer's Expectations? *International Journal of Engineering & Technology*, 7(2.29), 519-523, 2018.
[25] L. Reave, "Technical Communication Instruction in Engineering Schools: A Survey of Top-Ranked U.S. and Canadian Programs," *Journal of Business and Technical Communication* 18(4), 452-490, 2004.
[26] J. Qadir, K-L Yau, M. Imran, and A. Al-Fuqaha, "Engineering education, moving into 2020s: Essential competencies for effective 21st century electrical & computer engineers," in 2020 IEEE Frontiers in Education Conference (FIE), pp. 1-9. IEEE, 2020.
[27] K. Kövesi and P. Csizmadia, "Industry perception of new engineering graduates: the gap between requirements and reality," Proceedings of 44th SEFI Conference, 12-15 September 2016, Tampere, Finland.
[28] A. Azmi, Y. Kamin, M. Noordin, and A. Nasir, "Towards Industrial Revolution 4.0: Employers' Expectations on Fresh Engineering Graduates," *International Journal of Engineering & Technology* 7(4.28), 267-272, 2018.
[29] E. Seat, J. Parsons, and W. Poppen, "Enabling Engineering Performance Skills: A Program to Teach Communication, Leadership, and Teamwork," *Journal of Engineering Education* 90(1), 7-12, 2001.