

PROFESSIONAL SKILLS NEEDED BY OUR GRADUATES

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What skills are needed by university and college graduates so that they do well in their careers? Yes, we expect our graduates to be well grounded in the fundamentals and practice of their discipline. But what about so-called professional or career skills such as problem solving and communication? For engineering graduates the accreditation agencies, ABET^[1] in the United States and CEAB^[2] in Canada, expect graduates to possess skills such as teamwork, lifelong learning, problem solving and communication, and others. A key article^[3] suggests how these professional skills might be developed in engineering programs. Are these skills currently needed and used by current graduates in their first 10 years? Should the outcomes and attribute lists of engineering accreditation agencies be updated? Are there other professional skills that might be considered that graduates value highly in their professional practice?

Four surveys of business and industry have given feedback about the skills recruiters are looking for in graduates of colleges and universities and skills use by our graduates.

In 2010, Dean Blgrave^[4] of the Faculty of Arts and Social Sciences at Huron University College held discussions with 20 business leaders on Liberal Arts for Life. This led to a survey of recruiters to identify key skills needed for success. The survey response in 2012 (N= 45) was that oral communication and written communication each weighed in at “very important” for 93% of respondents. Teamwork, problem solving, critical thinking, ethical decision making, and analytical thinking were each ranked “very important” by 87% of respondents. Computer skills were ranked as very important by only 33% of the respondents.

Concerning frequency of use, 87% of respondents reported that proficient written communication was a daily requirement, and for 80%, effective oral communication was a daily need. Understanding of organizational structures and ethical decision making were a daily requirement for 40% of respondents. Problem solving, critical thinking, and time management were competencies reported to be called on daily by 73% of respondents. Creativity was seen to be used daily by only 33% of respondents, but 60% applied it weekly.

In the second study, surveys of employers of graduates of Tennessee Technological University from a wide variety of

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majors were done in 2003 and 2008 (N= 139). Figure 1 shows the results from the 2003 survey; Figure 2, the results from the 2008 survey. Those skills with the highest rating on both surveys were teamwork, problem solving, and communication. The more recent survey added learning skills, technical skills, critical thinking, and adaptability as having almost the same high rating. The surveys considered importance, and did not ask about frequency of use.^[5,6]

The third study, from Japan, considered engineering graduates working in the materials field.^[7] In 2006, a survey of 17 industries showed that the professional skills that the highest percentage of companies expected of undergraduate hires were, in decreasing order of importance: communication, problem identification, teamwork, initiative, the ability to comprehend a situation, and flexibility. In 2010, 116 graduates, about 10 years after graduation, were asked to free write about specific skills improved through university education. High scores were given to research, oral and written communication, problem solving, and critical thinking. Many reported that the professional skills were mainly developed through extracurricular activities while at university.

These three studies asked employers to identify important skills. It is not clear when these skills would be used by the graduates although it might be assumed to be in their early years of employment.

In the fourth study, Passow^[8] surveyed graduates in 11 engineering disciplines. Her excellent survey asked graduates (from 1989–2003) to rate the importance, in practice, of the 11 knowledge areas and skills given in the ABET criteria. The top four knowledge areas and skills (in the category quite important to extremely important) were teamwork, communication, data analysis, and problem solving. The next three in importance were math, ethics in science and engineering, and lifelong learning. The lowest five, in the category “somewhat important” to “quite important,” were: design; engineering tools; contemporary issues; experiments; and understanding the social, economic, and environmental impact. What is interesting is that some professional skills are rated more important

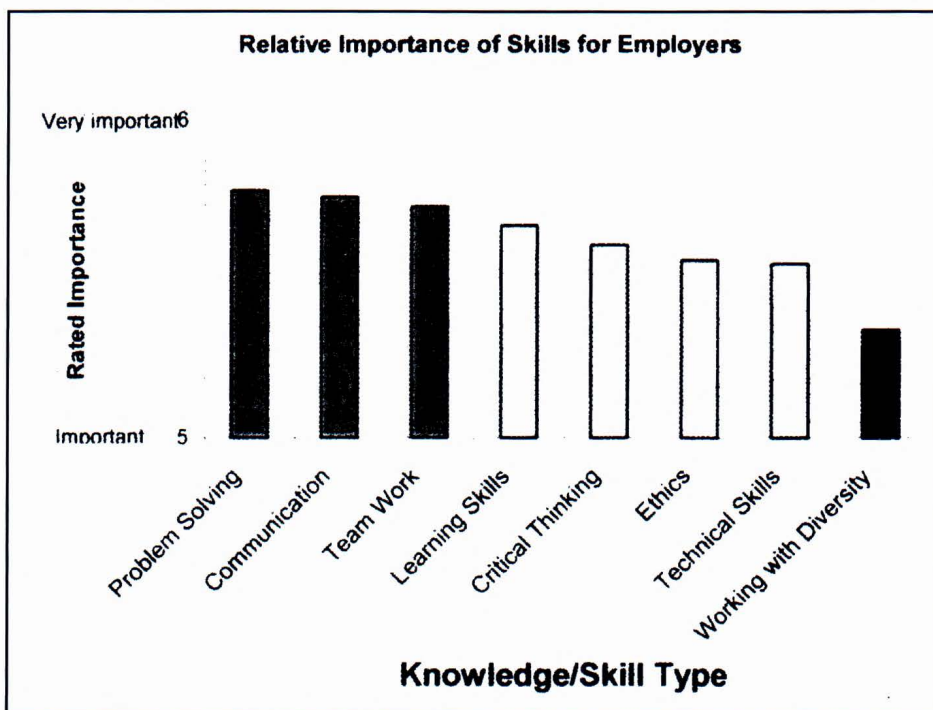


Figure 1. (2003 TTU Employer Survey) Reproduced with permission from the author, Barry Stein.^[5]

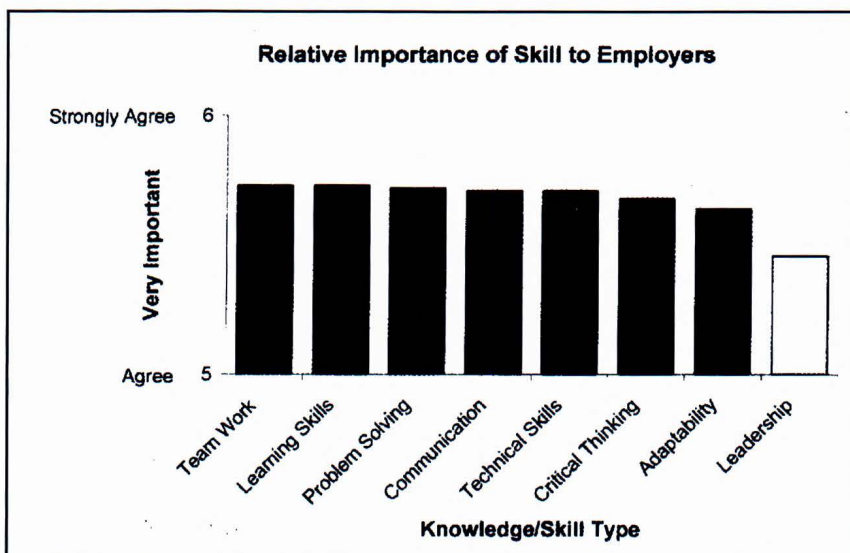


Figure 2. (2008 employer survey of TTU)^[6] Reproduced with permission from the author, Barry Stein.^[6]

than subject knowledge in three of the surveys. The survey of engineers working in the Japanese iron and steel industry and Passow’s survey of 11 engineering disciplines focused on graduates with 10 years of experience. For the Japanese study, these graduates listed six skills of importance. Passow’s study focused on the ABET criteria. Our interest is to identify the skills that we should be developing in our students before they graduate. We liked the idea of rating the

importance and gaining information about the frequency of use. We also focused beyond engineering programs. As did the first two surveys, we wanted to identify skills needed by most, if not all, graduates in any subject program from universities or colleges. Our goal was to contact those who graduated between 1990 and 2005 in any discipline and ask each to identify important and frequently used skills they needed in the first 10 years of their career. Since the survey was circulated to many people in personal networks, those respondents who were older, and even retired, were asked to respond from the viewpoint of the first 10 years of their careers. Our rationale in choosing the first 10 years is as follows. We wanted to identify the skills that our graduates need soon after graduation. We think these would have our top priority for development. Secondly, as professionals advance in their career, they develop those additional skills needed either naturally or by attending development programs and workshops. As an example of professional advancement in engineering, the Association of Professional Engineers of Ontario describes seven levels of professional practice of which the first five are most pertinent since these consider engineers in the first 10 years since graduation. Level A, entry level: routine technical decisions, works under close supervision. Level B, two to three years from graduation: assignments of limited scope and complexity; technical guidance available and results reviewed. Level C, three to five years from graduation, independent studies of difficult, complex, and unusual situations; usually not supervised. Level D, minimum five to eight years experience, supervisor, assigns and outlines projects, advises on technical problems, and reviews for technical accuracy; the time perspective is usually one year. Level E, minimum nine to 12 years, makes responsible decisions that are not usually subject to technical review, coordinates work programs, acts to expedite projects; the time perspective is usually about two years. The emphasis for Levels A to C is on calculations and projects whereas for levels D and E this shifts to projects, people, and decision making. Further, to be promoted the skills needed at the next higher levels of professional practice should probably be in place by the end of the 10 years. It is from this perspective that we selected the skills to be included and the first-10-year perspective.

1. SKILLS TARGETED FOR THE SURVEY

The survey is included in the Appendix. First, we wanted to include most of the skills described in the previous studies and important for engineering accreditation,^[1-3] although we decided to focus on only the professional or career skills. We included skills in chairing meetings or being a chairperson, change management, verbal and written communication, creativity, decision making, initiative, intercultural understanding, leadership, lifelong learning, problem solving, research skills, self-assessment, stress management, teamwork, and time management. We separated the four elements of “analytical thinking” into two: analysis (classification, series, and

consistency) and critical thinking. Next, some research suggests the importance of what is called emotional intelligence or emotional quotient, EQ.^[9-12] There is some disagreement as to which skills and emotions should be included in EQ.^[12-15] Nevertheless the following five skills were included by all authors: trust, empathy, social awareness and management of relationships, self-confidence and self-awareness, and management of emotions. Thus, we had a set of 23 skills in this survey.

2. METHODOLOGY

Just as was done in the first two surveys described above, we wanted to survey professionals from many different disciplines, and not just engineering graduates. The survey was sent to about 350 people directly, and each was asked to pass the survey on to others in their professional network. At least 10 sent it to between 30 and 50 others in their network. We received 104 responses. The respondents were lawyers, doctors, elementary school and high school teachers, college and university teachers, ministers, veterinarians, nurses, occupational therapists, writers, artists, youth workers, engineers, businesspeople including entrepreneurs and managers, and accountants. In the sample, as best as we can tell, 33 graduated with engineering degrees—of whom several received MBAs (of those who focused on business), some are consultants, and some are lawyers.

3. RESULTS AND DISCUSSION

The results can be considered from five different points of view. The data can be considered based on importance and on frequency of use. Because the results for importance and frequency were so similar we combined the two using an arithmetic average of the pooled two sets of data. We also combined the five contributing elements of EQ and used the single entry for EQ to see its relative ranking. Of the 104 respondents, 33 had graduated in engineering. We analyzed their results. Consider each in turn.

3.1 Importance

For importance, those skills that 104 professionals rated as being between very important (5) and vital/absolutely essential (6) were, in order of decreasing importance: verbal communication (5.69; standard deviation, sd, 0.62), written communication (5.52; sd 0.70), problem solving (5.51; sd 0.61), time management (5.37; sd 0.81), decision making (5.24; sd 0.88), critical thinking (5.20; sd 0.84), initiative (5.18; sd 0.89), teamwork (5.14; sd 0.86), self-confidence (5.08; sd 0.86), and trust (5.03; sd 0.98). It is interesting to note that the standard deviations of those results > 5 are all less than 1. Those skills that were rated between moderate importance (3), important (4), and very important (5) were: stress management (4.94), social awareness and management of relationships (4.84), lifelong learning (4.83), self-awareness and management of emotions (4.71), leadership (4.62), self-

assessment (4.5), analysis (classification, series and patterns, and consistency) (4.36), empathy (4.22), creativity (4.22), change management of self and others (3.95), intercultural understanding (3.91), research (3.85), and skill in chairing meetings (3.40). The standard deviations range from 1.0 to 1.4 for those rated <5 (very important).

Based on these results, here are some points for discussion.

- 1) For the accreditation, ABET (indicated as 3() and CEAB (indicated as 3.1.) explicitly include analysis 3(b) 3.1.2, teamwork 3(d), 3.1.6; communication 3(g), 3.1.7; problem solving 3(e), 3.1.2; and lifelong learning 3(i), 3.1.12. These key skills identified by the Engineering Accreditation agencies are indeed in the top 10, except for lifelong learning (ranked 13th) and analysis (ranked 17th).
- 2) Those skills missing from being explicitly mentioned by accreditation include the following in the top 10: time management (ranked 4th), initiative (ranked 7th), self-confidence (ranked 9th), and trust (ranked 10th). Since analysis (ranked 17th) is explicitly included in the accreditation listing, all those ranked higher than 17th could be claimed to be important and worthy of inclusion in ABET documentation. This would include stress management, social skills and management of relationships, self-awareness and management of emotions, leadership, and self-assessment.
- 3) In most undergraduate engineering programs emphasis is placed on creativity (ranked 19th) and critical thinking (ranked 6th). Should we reconsider the emphasis we place on these?
- 4) The two surveys, of graduates from any discipline, rating importance (by Huron College University and Tennessee Technical University summarized in the literature review) include communication, problem solving, teamwork, learning skills, analytical thinking, decision making, and critical thinking. The missing skills in those surveys (that have higher ratings than 17, the rating for analytical thinking) include time management, confidence, initiation, trust, social awareness and management of relationships, stress management, self-awareness and management of emotions, and leadership.^[8]
- 5) Passow's survey of engineering graduates used the ABET words "data analysis," whereas our survey used the words "analytical thinking" and she combined oral and written communication into a single word: "communication." Her top ratings were teamwork, communication, data analysis, and problem solving—which agreed with our ratings except for data analysis. Lifelong learning in both surveys ranked much lower.
- 6) It should not be a surprise that chairperson skills were rated last at 3.4 while team skills were rated 5.14. Research^[16-18] about teams shows that a) an effective group/team works more effectively if there is a designated chairperson who facilitates the task and morale parts of group/team activity. Research also shows that b) leadership and chairperson roles should not be confused. The

chairperson facilitates the process and is usually the single person designated for this role for the time the group works together. Leadership is assumed by the person who has the most experience and knowledge for the issue under consideration at one time. Leadership moves from person to person as different issues are considered by the team. Nevertheless, professionals in the first 10 years, while they are team members, would not usually become chairpersons until, perhaps, in years 8 to 10. Indeed, one respondent was quite specific and indicated that during his first four years he was never chair but currently, in year five, he chairs meetings.

3.2 Frequency

For frequency, those 12 skills that professionals rated as being used between weekly (5) and daily (6) were, in order of decreasing frequency: verbal communication (5.98, sd 0.14), time management (5.78; sd 0.59), self-confidence (5.78; sd 0.88), written communication (5.76; sd 0.49), problem solving (5.56; sd 0.69), decision making (5.50; sd 0.75), teamwork (5.44; sd 0.78), critical thinking (5.39; sd 0.81), initiative (5.18; sd 0.95), trust (5.17; sd 1.01), social awareness and management of relationships (5.11; sd 1.15), and stress management (5.09; sd 1.06). It is interesting to note that the standard deviations of most of the results > 5 are less than 1.

Those skills rated between occasionally/once in three months (3), monthly (4), and weekly (5) were: self-awareness and management of emotions (5.0), leadership (5.0), analysis (classification, series and patterns, and consistency) (4.73), empathy (4.72), creativity (4.49), lifelong learning (4.44), self-assessment (4.20), intercultural understanding (4.15), change management of self and others (3.95), research (3.78) and skill in chairing meetings (3.47). The standard deviations were in the range 1.08 to 1.3 except for intercultural understanding that had a standard deviation of 1.48.

Based on these results, the points are as follows:

- 1) The top 12 skills based on frequency of use are the same as the ratings for importance discussed in Section 3.1. The only notable difference is that self-confidence was rated 9th in importance but ranked 3rd for frequency of use. Two additional skills—social awareness and management of relationship and stress management—moved into the top priority class based on frequency. The other skills shifted slightly to account for this change.
- 2) These top skills identified by the Engineering Accreditation agencies are indeed in the top 12, except for lifelong learning (ranked 18th) and analysis (ranked 15th).
- 3) In general the ratings for importance and frequency of use are essentially the same, although lifelong learning (ranked 13th in importance) was ranked 18th in frequency of use and two skills were added to the priority ranking.
- 4) Those skills missing from being explicitly mentioned by accreditation include the following in the top 12:

time management (ranked 2nd), initiative (ranked 9th), self-confidence (ranked 3rd), trust (ranked 10th), social awareness and management of relationships (ranked 11th), and stress management (ranked 12th). Since lifelong learning (ranked 18th) is explicitly included in the accreditation listing, all those ranked higher than 18th could be claimed to be important and worthy of inclusion in ABET documentation. This would include self-awareness and management of emotions, leadership, empathy, and creativity.

- 5) The Huron College University survey based on frequency of use, given in the literature review, includes communication, problem solving, teamwork, analytical thinking, decision making, time management, and critical thinking. The missing skills that have higher ratings than 15 (the rating for analytical thinking) include confidence, initiative, trust, social awareness and management of relationships, stress management, self-awareness and management of emotions, and leadership.

3.3 Combined importance and frequency of use

Because of the similarity in trends based on importance vs. frequency of use, an approach might be to pool the two sets of data and arithmetically average the results of importance and frequency. The results are shown in Figures 3 and 4. For combined importance and frequency of use, those skills that 104 professionals rated as being between very important and used weekly (5) and vital/absolutely essential and used daily (6) were, in order of decreasing importance: verbal communication (5.83, sd 0.48), written communication (5.64; sd 0.65), time management (5.57; sd 0.79), problem solving (5.56; sd 0.63), decision making (5.37; sd 0.84), teamwork (5.30; sd 0.84), critical thinking (5.30; sd 0.83), self-confidence (5.23; sd 0.90), initiative (5.21; sd 0.95), trust (5.10; sd 0.98), and stress management (5.0; sd 1.01).

Those skills rated between moderate importance and used once in three months (3), important and used monthly (4), and very important and used weekly (5), were: social awareness and management of relationships (4.97; sd 1.04), self-awareness and management of emotions (4.86; sd 1.11), leadership (4.67; sd 1.03), lifelong learning (4.63; sd 1.23), analysis (classification, series and patterns, and consistency) (4.55; sd 1.13), self-assessment (4.55; sd 1.14), empathy (4.48; sd 1.27), creativity (4.35; sd 1.16), intercultural understanding (4.03; sd 1.44), research (3.81; sd 1.15), change management of self and others (3.69; sd 1.19), and skill in chairing meetings (3.44; sd 1.3).

Since the general results are the same as discussed in Sections 3.1 and 3.2 further discussion seems redundant.

A minor change has occurred because of the criteria. For importance, there were 10 top skills. For frequency of use, there were 12 top skills (with additions of social awareness and management of relationships and stress management). For the combination of importance and frequency, there were 11 top skills with stress management being retained in this category.

3.4 Emotional Quotient, EQ, or Emotional Intelligence

EQ based on the characteristics used in this survey is the average among the five elements: trust, empathy, social awareness and management of relationships, self-confidence and self-awareness and management of emotions. For the combination of importance and frequency of use, $EQ = 4.95$, $sd = 1.12$. This places EQ skill just below the top 11, in between stress management and leadership.

As an aside, although the sample size is small, EQ for nurses ($N=9$) was 5.35 with $sd = 1.10$; for veterinarians it was ($N = 7$), 5.59 with $sd = 0.71$. This illustrates one of the weaknesses of this survey. Some professions, and subsets of professions, would show different ratings. Those who interact extensively with the people, such as nurses, veterinarians, lawyers, ministers, and those in sales, probably would have higher ratings for EQ elements. Those who work in relative isolation, such as accountants and computer programmers, might rate EQ as relatively unimportant and low frequency of use. Engineers who specialized in product design and new product development and design might rate creativity much higher. Research engineers would undoubtedly rate research skills much higher than almost last in this study. Nevertheless, for our purposes—identifying important and frequently used by our graduates during their first 10 years—we feel the results provide useful guidance as to the skills we should be prioritizing in our undergraduate programs.

3.5 Engineering graduate subsample

Of the 104 responses to our survey, 33 graduated with engineering degrees. Not all continued to practice engineering; some completed MBAs and went into business. Not all, but most, graduated as Chemical Engineers. For combined importance and frequency of use, those skills that 33 professionals rated as being between very important and used weekly (5) and vital/absolutely essential and used daily (6) were, in order of decreasing importance: verbal communication (5.8; sd 0.53), written communication (5.66; sd 0.59), time management (5.53; sd 0.81), problem solving (5.49; sd 0.74), decision making (5.19; sd 0.94), critical thinking (5.16; sd 0.90), teamwork (5.11; sd 0.97) and self-confidence (5.04; sd 1.0). The standard deviations of those results > 5 are all less than or equal to 1.

Those skills rated between moderate importance and used once in three months (3), important and used monthly (4), and very important and used weekly (5) were: initiative (4.9; sd 1.01), stress management (4.8 sd 1.18), trust (4.78; sd 1.08), social awareness and management of relationships (4.73; sd 1.2), self-awareness and management of emotions (4.71; sd 1.08), analysis (classification, series and patterns, and consistency) (4.53; sd 1.17), leadership (4.5; sd 1.03), lifelong learning (4.21; sd 1.53), creativity (4.04; sd 1.17), self-assessment (4.03; sd 1.15), skill in chairing meetings

(3.97; sd 1.38), empathy (3.94; sd 1.27), intercultural understanding (3.69; sd 1.5), research (3.67; sd 1.24), and change management of self and others (3.64; sd 1.21).

For EQ the rating was 4.63 with a standard deviation, sd, of 1.27.

- 1) For this sample of engineering graduates, only eight skills have ratings >5; whereas for the 104 sample, 11 skills had values >5. The skills that missed the >5 rating were initiative, stress management, and trust.
- 2) Most of the skills received lower ratings by the engineering graduate sample than the full 104 cohort.
- 3) In general, the ranking by the engineers was about the same as the full cohort.
- 4) The survey of Passow,^[8] using the ABET wording, showed about the same ratings with the exception of “data analysis” vs. “analysis” that was discussed in section 3.1. Although the two surveys were challenging to compare because different skills were considered, some top skills were rated higher than the engineering fundamentals,^[8] and the skills common to both surveys showed relative agreement in the rating.

4. SUGGESTIONS FOR IN-CLASS ACTIVITIES

If these are skills important for our graduates, from engineering or more generally from any discipline, in their first five to 10 years, what might we do in our courses to help our students acquire confidence and skill, especially in the top skills?

1. Do *something*. It is not easy to change your customary way of teaching; it takes time away from research and grant applications, from committee work and from keeping up-to-date in your subject specialty. Use intrinsic motivation to make that change. A 7-step intrinsic motivational process is 1) understand the context of your goals, the culture in which you work, and your personal life, 2) perceive a discrepancy between your current teaching and a perceived desired state of helping students acquire some of the top skills; set a goal, 3) acknowledge the ambivalence or the pros and cons for

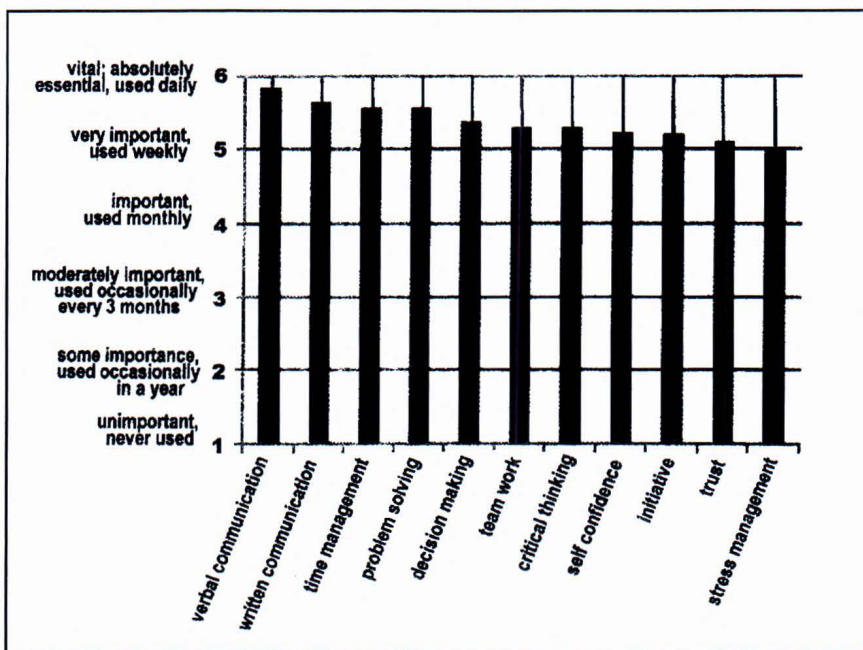


Figure 3. Important and used frequently. The top 11 skills. Sample, 104 responses.

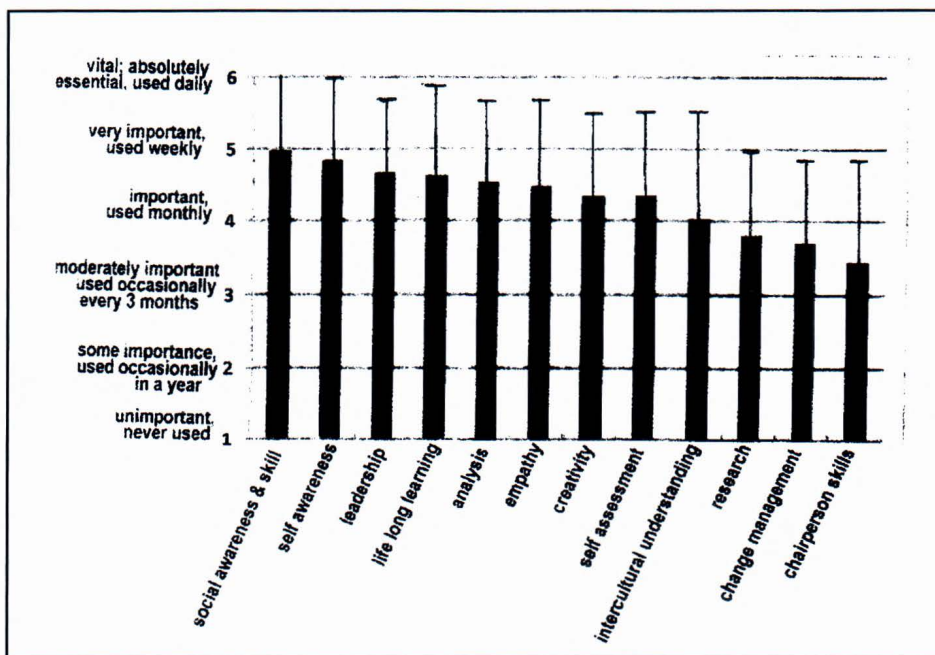


Figure 4, Important and used frequently. Skills that were important and used once in three months to those skills rated very important and used weekly. Sample, 104 responses.

changing your teaching, 4) accept that the pros exceed the cons and say “I want to.” 5) develop confidence that you can pull it off, 6) develop a plan, and 7) do it.^[19,20]

2. Talk with colleagues about what you and the department are doing and might be doing to explicitly help students develop confidence and skill with the professional skills.

3. In your first class, provide the context by emphasizing the need for skills via survey data: Figure 1 (to show the relative importance of the subject knowledge) and Figures 3 and 4 to show rich variety of skills valued by recent graduates to succeed in their career.

4. Select a skill with which you are comfortable working. Include in your class syllabus^[21] the context of how that skill will be developed in your course or the importance you place on it. For example, “Here’s what you can expect from me: understanding, teamwork so that by working together you will know that I want you to succeed in this course, trust and integrity, and good time management (in structuring our class activities and getting marked assignments back to you promptly). Here’s what I expect from you....”

5. Model the skills. Characteristics of peak-performing professors are that they: are enthusiastic, show integrity and ethics, and build trust. They are skilled at communication, listening, problem solving, critical thinking, interpersonal and group skills, and assessment. Demonstrate these skills in all you do.^[21]

6. For the skill selected, give students written goals for improvement. Hand out target behaviors that are based on research and evidence.^[21,22] Use a form or require a journal that asks students to monitor their progress in developing those skills.

7. Realize that internalization and development of the skill by the students will probably not occur by the previous suggestions one to five. Those five ideas create the atmosphere for the development and highlight your focus on trying to help your students acquire the skill. Most of these skills, however, cannot be acquired by reading, listening to, or watching others.^[23] For example, we, as experienced instructors in our subject discipline, cannot demonstrate problem solving. We know too much^[24]; at best we demonstrate exercise solving^[21,25] (or working forward from the given data to solve the problem by recalling and adjusting information from problems solved in the past). Rather, as Bandura^[26] recommends, we can use workshops with activities that ask students to try the skill and receive prompt positive feedback using the five strengths and the two areas to work on. Example workshops that have been proven to be effective in developing confidence and skills^[23] are available.^[22]

8. To help both you and your students celebrate progress, use pre- and post-tests available for your focus skill(s).^[27]

Now consider some suggestions specific to the top skills: communication, problem solving, time management, decision making, teamwork, critical thinking, self-confidence, trust, and stress management.

1. For communication skills, remind students that the fundamental concept is “if the message is not communicated, it’s your fault!” One of the frustrations that students have is that most instructors seem to use a different rubric for assessing students’ skill in communication: different criteria

for a speech, for a lab report, for a project report, and for a research report. Students become frustrated when trying to fulfill different rubrics. We should select an evidence-based marking scheme and use it for all communications (oral or written) in all courses in the program. An example evidence-based criteria/rubric has been developed.^[28,29]

- a) *Focus your feedback on five strengths and the two areas to work on. When we cover a student’s written report with many red-ink corrections and suggest “hundreds” of mistakes, students tend to give up in frustration. Our experience is that they feel defeated and give up on attempts to rework.*
- b) *We tend to emphasize what the final product—the report or the delivered speech—will look like. We can help students develop confidence and skill by sharing research about the process of writing a communication. Target skills summarizing that research about the writing process are available.^[21,22]*
- c) *For oral communication, we can use material from The Toastmasters organization.^[30] For example, in McMaster University’s required sophomore course on communication, Professor Jack Norman used in class the Toastmasters model to develop oral communication skills.*

2. For problem solving, research suggests that the biggest challenge is for students to spend time creating an accurate internal representation of the problem.^[31] Workshop material can be downloaded to help students become more aware of the process they use (MPS 1),^[22] use an organized strategy^[32] systematically (MPS 4),^[22] explore to create the internal representation (MPS 15),^[22] and create the look back (MPS 14).^[22]

3. We find that time management and stress management are interconnected. A basic book for time management, that was adapted to workshop form,^[22] is Covey.^[33] Download the two workshops (MPS 5 and MPS 17)^[22] on these topics and consider devoting 4 hours of workshops with your students. Timing, PowerPoints, and workshop materials are available.^[22] At McMaster, for our first attempt in 1982 to develop stress management skills (in a required sophomore course) we asked the Canadian Mental Health Association to run the 2 hour workshop. This worked well. Later, when we had more confidence, we ran the workshop.^[22] Initially, we did not appreciate the great need the students had for this workshop. (However, we soon realized its importance because, on the Holmes Rahe inventory of annual stress,^[22,34] most of us score in the range 150 to 300; however, more than 30% of our students have > 600 and some have >1,000.)

4. For decision making, teamwork, and critical thinking, workshop materials have been developed and are available (MPS 24, MPS 28, and MPS 30),^[22] with some details about teamwork available in addition.^[31] We use group work in many of our learning activities. A valuable investment for your students is to give them a 50 min. activity to address 17 issues that contribute to the group culture.^[35]

5. For self-confidence, Bandura's 6-step model^[26] of the process to develop self-confidence is useful. His steps are 1) self-awareness, 2) awareness of others, 3) self-acceptance and acceptance of others, 4) know target behaviors and accept that assessment is based on performance—not self-worth—and that key elements include trust, initiative, and willingness to risk, and positive self talk, 5) “enactive mastery” in which you successfully complete achievable goals posed by others and get positive feedback, and 6) “enactive mastery” where you set your own achievable goals, achieve them, and self-assess your success. Self-confidence results.

For steps 1 and 2 to improve self-awareness and awareness of others, we recommend that the students complete about a dozen inventories related to their style of relating (Jungian typology or Myers Briggs,^[36] Kellner Sheffield inventory^[37] about self-image and long-term/short-term stress, FIRO B^[38,39] for roles in teams/groups, Risk or Kirton KAI^[40] about how you use your creativity, Johnson's style of conflict^[41] resolution, Rotter locus of control,^[42] Basadur's attitude about creativity,^[43] Self-Directed Learning Readiness scale related to lifelong learning,^[44-46,27] approaches to studying related to your lifelong learning style,^[47] Holmes Rahe related to annual stress,^[34] Billings Moos related to problem solving and problem avoidance,^[48] Weinstein's Learning and Study Strategies Inventory, LASSI,^[49] Heppner's PSI^[50] related to confidence in problem solving, Perry inventory^[47] related to students' attitude about their role in learning and Beck's happiness scale^[51]). Enrich that experience by having activities to help them see and appreciate the styles of others. Such example activities are given in MPS 11, “the unique you.”^[22]

For steps 4 to 6 in Bandura's model, self-assessment, although not in the top 10, is a skill that is needed.

Skill in self-assessment is also very useful to provide self- and peer assessment of learning activities and group work, and that helps with students writing resumes and learning journals.^[52] Workshop activities for self-assessment are available (MPS 3).^[22]

For steps 5 and 6 in Bandura's model, students are assigned a series of tasks where, with coaching, they build success upon success. Thus, their self-confidence increases. Scaffolding^[52] is a learning approach you can use to achieve this. Scaffolding is empowering students through learning with stagewise training. You have temporary and adjusted roles starting with introduction and rationalization of the task, then modeling how you solve the task, then guiding them (via resources, scripts, questions, templates, storyboards) as they tackle and successfully complete the task. You coach as they tackle more complex tasks, support them, and finally fade because your assistance is no longer needed while they solve more complex tasks successfully.^[52]

6. For trust three components are competency, integrity, and benevolence. Suggestions about how to measure and develop trust are available.^[21]

7. For Emotional Intelligence or Quotient, the components include 1) trust, 2) empathy, 3) social awareness and management of relationships, 4) self-confidence, and 5) self-awareness and management of your emotions. Many of these behaviors have been discussed previously in this paper. Workshop materials on listening and conflict resolution are available.^[22] Drummond provides suggestions about developing emotional intelligence.^[15]

SUMMARY

The results from four different surveys related to the skills needed by professionals showed top importance and frequency of use to be communication skills, problem solving, team skills, and critical thinking. The current survey asked young professionals in many different professions to identify the importance and frequency of use of 23 “skills.”

The results (from a sample of 104 respondees) were that the top skills in importance and frequency of use were verbal communication, written communication, time management, problem solving, decision making, critical thinking, teamwork, self-confidence, initiative, trust, and stress management. Those that were important and used weekly to occasionally in three months were social awareness and management of relationships, self-awareness and management of emotions, leadership, lifelong learning, analysis (classification, series and patterns, and consistency), self assessment, empathy, creativity, intercultural understanding, research, change management of self and others, and chairperson skills. A consideration of those who graduated with engineering degrees suggests little change from the responses from the total sample. Some of the professional skills important for graduates are not considered explicitly in the accreditation criteria.

Some of these skills are components of emotional intelligence (trust, empathy, social awareness and management of emotions, self-confidence, and self-awareness and management of emotions). Subject to the limitation that these are the component skills used to represent EQ, EQ was rated by the respondees as being very important and used weekly.

Some suggestions are given on what to do in your courses to develop skill and confidence in those key skills needed for your students' careers.

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APPENDIX

Skill survey

Many general skills are needed by our university graduates for them to have successful careers. Of the many, we want to identify the ones that should have top priority in undergraduate and graduate programs. Which ones would be most important for their career development in the first 10 years after graduation? Please rate importance: unimportant = 1; some importance = 2; moderate importance = 3; important = 4; very important = 5; and vital, absolutely essential = 6.

Please rate frequency of use: never = 1; occasionally in a year = 2; occasionally every 3 months = 3; monthly = 4; weekly = 5; daily = 6. ☐

Skill	importance	frequency of use
analysis: classification, series, consistency		
chairperson skills, running meetings		
change management, for self and others		
communication, verbal		
communication, written		
creativity		
critical thinking		
decision making		
empathy		
initiative		
intercultural understanding		
leadership		
lifelong learning		
problem solving		
research skills		
self-awareness and management of emotions		
self-assessment		
self-confidence		
social awareness and management of relationships		
stress management		
teamwork		
time management		
trust, developing and maintaining		