

How Soft Are 'Soft Skills' in the Engineering Profession?

B Colman

Final Year Undergraduate Engineer

P Willmot

Principal Teacher/National Teaching Fellow

Loughborough University

Loughborough, UK

p.willmot @lboro.ac.uk

Conference Key Areas: Engineering Skills, Curriculum Development, Engineering Education Research.

Keywords: Employability, skills, curriculum.

1. INTRODUCTION

The modern global economy is extremely competitive. An engineering company's competitive advantage comes not only from its products but also from the professional service it delivers. Companies need employees who, in addition to being technically proficient, are well rounded individuals who have the necessary interpersonal skills and personality traits to succeed in project delivery. Recently, there has been a paradigm shift to companies becoming more people focused; this has been driven by the increase in the size and complexity of supply chains, technology and organisational integration.

This paper reports on a research project that used both existing literature and new primary research data to explore the apparently growing importance of so called "soft skills" within engineering professionals: a term that is often used to describe the development of a person's professional relationships with other people and building their emotional intelligence. Emotional intelligence (EI) is the capacity of individuals to recognise their own, and other people's emotions, to discriminate between different feelings, label them appropriately and to use emotional information to guide thinking and behaviour.

From the outset it was established that 'soft skills' are called many other names, such as transferable skills, key skills and life skills; 'hard skills' more commonly referred to technical or scientific skills. Whilst technical skills are still dominant there appears to have been a transition, and the recruitment of graduate engineers now seems to focus more on soft skill competencies. At the outset, it was thought that the colloquial terms 'soft' and 'hard' might be misleading here as they seem to imply a different level of difficulty, hence, the need to determine just how soft are 'soft' skills?

2. LITERATURE REVIEW FINDINGS

Hard skills are relatively easy to quantify and observe, these can be qualifications, certifications etc; in contrast soft skills are extremely hard to quantify and observe [1].

Communication and interpersonal skills are continually identified in the literature to be the most important soft skills in engineering. Chou [2,] suggests *“Hard skills help us qualify for a job; soft skills dictate our career growth”*

In addition the following simplistic equation was proposed by Goldberg [3,] *“Technical Skills + Life Skills = Engineer”* which represents the importance of soft skills in addition to hard skills and technical prowess. Goldberg further suggests that students spend 80% of their time studying technical subjects but these technical skills developed only constitute 20% of an individual’s working day.

Several studies have highlighted the perception from industry professionals of a soft skills gap that exists within graduates. The authors Kumar and Hsiao [4,] stated that *“Engineers learn soft skills the hard way”* supporting the theory that engineers are continuously entering the market place technically qualified but not sufficiently competent in soft skills.

The literature reviewed discusses how the education system is currently too focused on quantifiable hard skills meaning that soft skill development is often neglected. It has been proposed that soft skills are the most difficult to teach and assess in education, notwithstanding the fact that most teachers in engineering higher education are technical specialists who often also lack formal training in ‘people’ skills. Further arguments refer to the best method providing for their development broaden the research area; crudely, whether soft skills can be ‘caught’ or ‘taught’.

Official accreditors including the UK Engineering Council have identified the need for soft skills to be included in the curricula of the education system [5]. The Institution of Mechanical Engineers encourages continuous professional development to ensure engineer’s skill competencies match the developments of the modern world [6].

3. RESEARCH METHODOLOGY

The present research project focuses on six key questions determined from the literature review findings:

1. Why are soft skills perceived as soft?
2. How important are soft skills perceived to be in engineering?
3. Which soft skills are perceived as the most important in the engineering profession?
4. What are the most appropriate methods to promote skills development?
5. Where does the responsibility lie for graduate soft skill development?
6. How effective is the current education system in preparing students for employment?

Primary research was conducted through quantitative (A), qualitative (B) and observational (C) research methodologies:

- A. Online Survey Questionnaire available to Engineering Students
- B. In-depth interviews encompassing Engineering Students, Academic Professionals, Recruitment Professionals and Industry Professionals
- C. Engineering Student mentoring programme as part of Engineering Management undergraduate studies

3.1. Quantitative Data Collection

The online survey questionnaire achieved 108 responses. 89% of the participants were from Loughborough University, with the remaining 11% representing a range of Universities (as shown in Figure 1) including University of Warwick, University of Manchester and University College, London.

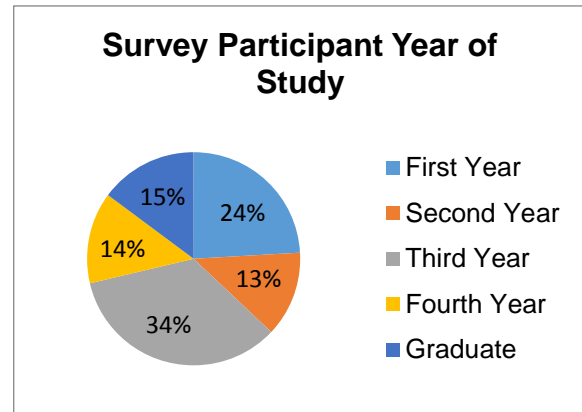
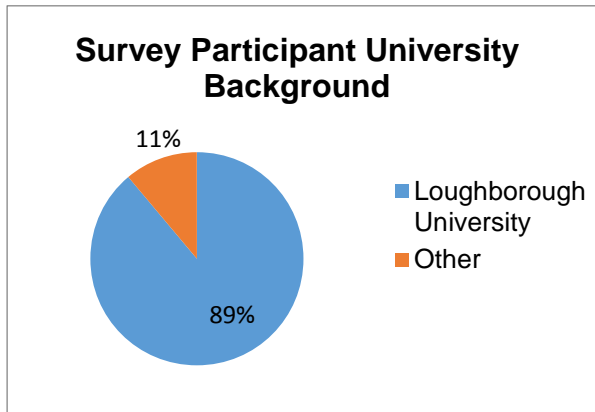


Fig. 1 – Diagram Showing Survey Participant

Fig. 2 – Diagram Showing Survey Participant

The survey sample population represented a wide range of student profiles including first, second, third and fourth year students and also some recent graduates as shown in Figure 2.

3.2. Qualitative Data Collection

A total of 18 in-depth structured interviews were carried out as part of the qualitative data collection. The participants are shown in figure 3 and represented four different spheres of interest; all had a direct connection with engineering.

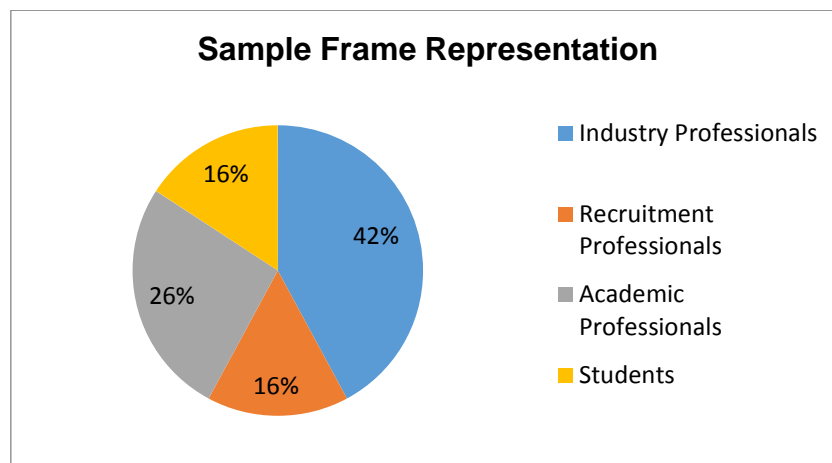


Fig. 3 – Diagram Showing the Qualitative Research Sample Frame Representation

Industry Professionals with backgrounds in; Aeronautical Engineering, Nuclear Engineering, Manufacturing Engineering, Chemical Engineering and Materials Engineering. Key companies represented here included Rolls-Royce Submarines, Rolls-Royce Aerospace, British Petroleum (BP) and Unilever.

Recruitment professionals included a Human Resource Director from Portakabin, a careers consultant with BPP and a representative from the Loughborough University Student Careers Consultancy Team.

Academic Professionals were taken from Loughborough University and Bradford University.

Students interviewed were studying Aeronautical Engineering, Automotive Engineering and Engineering Management at Loughborough University in their third year of studies.

4. FINDINGS AND DISCUSSIONS

The following section condenses the key findings, theories and opinions collected from the quantitative, qualitative and observational research.

4.1. Why are Soft Skills Perceived as Soft?

The word 'soft' has several different meanings. Soft skills are referred to as soft because they are much more difficult to quantify when compared to hard (technical) skills. They are more difficult to define and thus to teach by conventional methods. Conversely, less merit is attached to soft skill competence and hence they are often perceived as easier than 'hard' skills. Nevertheless, they are often perceived as the most valuable skills to have. Soft skills are strongly associated with a person's emotional intelligence. Unfortunately, however, to emotive is perceived by some, particularly those who confine their thoughts to higher technical concepts, as weak or 'soft'. An interesting definition was proposed by one of the respondents – *"soft skills are 'soft' enough to be moulded and shaped to improve a person's personality traits."*

The term 'soft' contrasts with the term hard; hard technical skills are often factual based and hence imply the idea of 'hard truth'. An interesting concept was introduced by a Loughborough University academic at interview. He compared soft and hard skills to software and hardware, suggesting that hardware like hard skills is more tangible, visual and easier to understand.

4.2. How important are soft skills perceived to be in engineering?

92% of the survey population agreed that soft skills are important in engineering, however 71% also believed that, in terms of technical engineering capability, hard skills are more important than soft skills, which suggests that soft skills support hard skills.

82% of participants agreed that hard skills help engineers qualify for a job, but soft skills dictate career growth and progression. After further thematic analysis it was concluded that whilst hard skills qualify an individual for a job or role, the majority believed that soft skills are more desirable than hard skills when determining a candidate's employability.

An industrial contributor suggested that with the increases in technology and automation, human soft skills will become more dominant in the future of the engineering profession as engineers become management focused. Similarly

another industrialist stressed that, traditionally an engineer's role was to provide excellent technical engineering expertise. Today the lines between functions, managers and across the whole hierarchy are much more 'blurred'. This increased integration means that engineers need to be more rounded and have skills beyond technology. Nowadays, successful individuals who work with others need to develop strong EI.

A Human Resource Director who was interviewed, stressed that, modern day engineers never work in isolation; they are continually working in diverse teams and collaborating on projects. This puts a very high importance on soft skills to ensure the projects are successfully completed on time and on budget. In addition whilst the size and complexity of projects has increased, there is also increased diversity and the need to demonstrate transparency.

4.3. Which Soft Skills are Perceived as the Most Important?

80% of the survey respondents identified communication (oral, written, body language, listening skills and etiquette) as very important, 72% identified teamwork as very important and 44% identified time management as very important. With regards to the top three hard skills identified by the survey population, 78% identified technical problem solving as very important, 65% identified technical knowledge as very important and 54% identified analytical capability as very important.

The in-depth interviews, confirmed that communication was clearly the most important skill. Teamwork was also identified as imperative within engineering which some defined as both a hard and soft skill. However the majority believed that communication skills were the building blocks to many other skills including effective teamwork. The ability for an individual to be able to tailor their communication style to the audience and environment is very difficult to master, but is essential in a successful manager.

4.4. What are the most appropriate methods to promote skills development?

Participants believed that soft skills can be both learned through application (caught) and taught in theory. The following paragraphs, however suggest that formal teaching actually plays only a minor role in skills development. It was suggested that the base level ability of an individual's soft skills is an innate ability from birth and developed from a very early age in the home. This supports the importance of the primary and secondary education system in developing the younger population in soft skills

Many of the recruitment professionals along with the students believed that the best way to develop soft skills is through application and experience. The students in particular identified the industrial year-long placements as part of their degrees as key to their personal and professional development and in preparing them for working life.

The UK has both a minority 'private' (fee paying) and a majority 'state' (free) school sector. Many of the interview participants remarked that private schools are superior to state schools in developing soft skills, there being more time and investment available. This supports the idea that the environment in which people learn contributes greatly to soft skills development. In private schools, students are

generally encouraged to take on responsibility, develop organisational skills and learn to speak in public through clubs and committees. The interviewed participants identified, in particular, that former private school students tend to be better at communication and leadership. However it was noted that these same students are only exposed to a narrow range of people, values and backgrounds, and that if the more diverse state schools could adopt similar practices, this would be an ideal environment to develop soft skills. A similar argument can logically be made for developing these skills later in life, at university.

4.5. Where Does the Responsibility Lie for Graduate Soft Skill Development?

Only 8% believed the responsibility for graduate soft skills development should belong with Higher Education (HE) institutions only; 67% of participants believed that the responsibility for soft skill development should belong with all parties (HE, schools, employers and with the individual). This was fully supported by the qualitative interviews. The full results are shown in Figure 4.

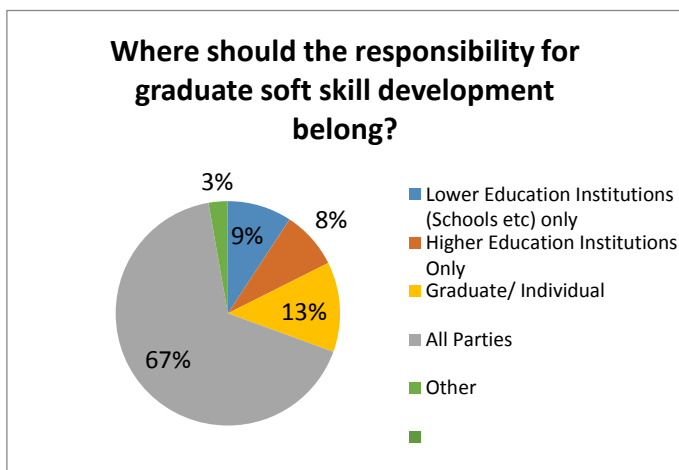


Fig. 4 – Diagram Showing the Online Survey Questionnaire Responses

It was concluded that Universities primarily exist to teach students in the discipline being studied; it is the graduates' individual responsibility to develop their soft skills, however there must be adequate support provided to facilitate their development. When in employment, it is the individual's responsibility to implement continuous professional development (CPD) however; employers should have structured training available to support this development.

4.6. How Effective is the Current Education System in Preparing Students for Employment?

Notwithstanding the foregoing comments, all interview participants supported the separate survey findings that currently, soft skills are not sufficiently emphasised in the University curricula.

The student participants believed that the best way to introduce more soft skill development is to change the method of learning in the technical subjects, rather than directly teach soft skills. At Loughborough University, students found group based work extremely beneficial to learn and develop how they operate together and indirectly develop their competences. Students also commented that once in employment, the hard skills learnt can become quickly outdated, and therefore the HE curricula should try to create a better balance between soft and hard skills, in order to create more rounded and flexible individuals who become more effective employees and managers.

From the academic professional perspective, work experience was seen as the main contributor to soft skill development. Academics are often heavily involved in

research which is generally hard skills based and dictates University curricula. This creates a bias towards hard skills and pushes soft skills aside, often to the point of disdain.

The majority of the survey and interview population believe that University curricula are currently too focused on hard skills. However the time constraints that exist mean that inclusion of all hard skill requirements are the priority.

5. OBSERVATIONAL RESEARCH

An existing peer-mentoring programme, where a small group of finalists are assigned to mentor less experienced teams, was used as a method of observational research to objectively measure and observe the effect of such skills based modules within the University curriculum. Of the four mentors, each one increased their skill competence in approximately five skills out of 10 on average.

Mentoring is a two way relationship between the mentor and mentees; therefore there are many benefits that can be gained. The student mentees all believed they had benefited hugely from the mentoring programme and that it had facilitated their soft skill development. Whilst gaining experience in working as a team to complete a complex project, the student mentees found it particularly beneficial to work alongside the mentor, learning from the additional experience they possessed. It was further stated that the act of identifying their soft skill and EI competence before and after, facilitated self-reflection which is an extremely important aspect in CPD.

6. CONCLUSIONS

There are several different terms that have been referred to here as 'soft' and 'hard' skills. These commonly used terms were identified from the outset as ambiguous and potentially derogatory (soft skills); as such, transferable, interpersonal and people skills were preferred terms to refer to these skills. The new research, described here, supported and reinforced the findings of literature review.

The research found soft skills difficult to bound, quantify, observe and teach; they tend to be subjective and perceived, by some technocrats as unworthy'. Soft skills, on the other hand, support and implement 'hard', quantifiable skills and are identified as soft because of their personal, emotional and less tangible nature.

The traditional perception that soft skills are less important than hard skills identified in the literature was explored. It was widely agreed that this perception exists, but this research suggests that soft skills are equally important in the modern engineering profession.

The online survey questionnaire identified communication as the most important 'soft' skill within engineering. Communication is essential to ensure the project groups are aligned and working collaboratively. Furthermore when engineering provides a service to the client, good communication is imperative to providing a professional service.

The literature identified a graduate soft skills gap. On balance the research findings did not support this proposal; close links exist between leading UK Universities and

industry to assist in structuring the most appropriate degree courses, and whilst large employers offer additional in-house training to augment existing skills, the competitive recruitment process that exists today to secure graduate engineering positions ensures that only those candidates with strong 'soft' skills are chosen.

It has been suggested that a person's ability in soft skills and EI largely depends on their innate personality traits. However these findings show that soft skills can be both taught and developed through experience and application. The development of individuals from a young age is extremely important to create a strong base to build on throughout their lives. The data collected highlighted that work experience; mentoring and industrial placements have been identified as vital methods for developing graduates in soft skills and therefore employability.

The research suggests that soft skills development should be a shared responsibility. Both lower and higher education institutions, employers, parents and the individual all have a part to play. In addition the survey of students suggested that higher education institutions are currently too heavily focused on technical skills and that they have the main responsibility to ensure graduate employability.

Many of the participants involved in the interview process believed that the research area is important and extremely transferable to any industry sector or profession. This emphasises the importance of soft skills in respect of employability, personal development and career progression and, ultimately, to business growth and success both within and outside the engineering profession

- [1] Mala, E. Soft Skills for Engineering, [Online] no date, <http://www.ktit.pf.ukf.sk/images/clanky/Dokumenty/Desire/Softskillsforengineers.pdf> (Accessed 28 March 2016).
- [2] Chou,BW. Fast tracking your career: soft skills for engineering and IT professionals, p.21, 1st ed. New York: John Wiley & Sons; 2013.
- [3] Goldberg, DE. Life Skills and Leadership for Engineers, p.144, 1st ed. New York: McGraw-Hill Inc US; 1994.
- [4] Kumar S, Hsiao K. Engineers Learn "Soft Skills the Hard Way": Planting a Seed of Leadership in Engineering Classes. p.18, Leadership and Management in Engineering 2007
- [5] Royal Academy of Engineering . Thinking like an engineer, implications for the education system. Centre for Real Work World Learning, University of Winchester: Royal Academy of Engineering; 2014
- [6] Institution of Mechanical Engineers. Competence Framework and UK-SPEC, [Online]<http://www.imeche.org/membership-registration/professional-development-and-cpd/working-towards-professional-registration/competence-framework-uk-spec> (Accessed 31 March 2016)