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The Academic Perspective: A study of academic conceptions of the importance of professional skills in engineering programmes in Ireland



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Introduction

This presentation outlines a phenomenographic research study which aims to explore engineering academics experiences and conceptions towards developing professional skills within engineering students in Ireland. The research is undertaken in two phases. Phase One is an online survey circulated to academics teaching on engineering programmes in Ireland (n=273). Phase Two will consist of in-depth interviews.

The overall phenomenographic study aims to answer the research question;

- What are the qualitatively different ways that academics experience and conceptualise teaching and the development of professional skills in engineering programmes in Ireland?

This presentation reports on the results of the Phase 1 survey. Whilst the principal aim of the survey was to identify participants for Phase 2 interviews, we also sought to answer the following research question;

- What factors influence an academic's consideration of the relative importance of specific professional skills?

The outcomes highlight aspects of an academic's life experience which has an influence on their views on the importance of professional skills, which we suggest influences their actions in the classroom and the curriculum itself. The results of this survey provide an initial insight into the perceptions held by academic staff, which will be explored further in the main phenomenographic study.

Context

Engineering graduates in today's world face a global industry where professional skills are as important as the intellectual prowess gained by obtaining a degree itself. The acknowledgement of the importance of these skills is abundant in literature, yet so too is an ongoing barrage from industry that Higher Educational Institutions (HEIs) are not developing sufficient professional skills within students (IOT, 2011).

Much has been written in the last ten years about the need for reform in engineering education and in particular the need to prepare graduates to work on a global scale in diverse teams (UNESCO, 2010; ASEE, 2013; Wulf, 2008; Miller, 2015). Engineering education research has responded by informing innovative teaching pedagogies but there is limited research investigating the human influence on engineering education; the academic's perspective

Survey Design

An online survey was circulated to all academics teaching on engineering programmes in Ireland. A response rate of 34% was achieved and n=273 (29%) respondents answered all questions. The survey collected demographic information on; gender, age, employer, qualifications, membership of professional bodies, extent of academic experience, role and number of teaching hours, extent of industry experience, involvement with graduate recruitment or initial training of graduates.

Respondents were also asked to score the importance of a list of professional skills for today's engineering graduates. The list of skills was created from a systematic literature review of recent engineering educational publications and research papers and comprised 17 'non technical' skills with just one 'technical' skill option. The survey aimed to show some correlations and relationships between different aspects of the response data.

Findings

This presentation is limited to highlighting the results of the relative importance of professional skills only. A sliding scale was provided with 'Not important' (scored as 0) to 'Essential' (scored as 4). Table 1 shows the average score for a selection of skills differentiated by gender.

Table 1. Average scores of respondents on the importance of specific skills

	Female Average Score(n=60)	Male Average Score (n=197)	Difference between Female - Male score
Problem Solving	3.78	3.71	0.08
Communication	3.71	3.59	0.12
Critical Thinking	3.78	3.53	0.26
Practical Focus	3.69	3.50	0.19
Self-Direction	3.62	3.44	0.17
Teamwork & Collaboration Skills	3.71	3.41	0.30
Character and Interpersonal Skills	3.60	3.27	0.33*
Excellence in Technical Skills	3.17	3.23	-0.07*
Project Management	3.22	3.07	0.14*
Health & Safety	3.20	2.94	0.26
Research Skills	3.12	2.82	0.31
Risk Management	2.97	2.66	0.31
Leadership	2.82	2.56	0.26
Global Outlook	2.80	2.46	0.34
Business Acumen	2.42	2.31	0.10
General Knowledge	2.15	2.01	0.15
Foreign Language Skills	1.58	1.43	0.16

*Indicates cases in which a statistically significant correlation was observed with regard to gender.

In all but one professional skill, women appeared more likely to score more highly than men, i.e., they place more importance on each skill than men do. Only 'Excellence in technical skills' was scored as less important by women than men. Since excellence in technical skills could be considered the only technical skill presented within the survey, and all others are non-technical, this suggests that female academics place more importance on non-technical skills in engineering graduates than male academics.

Although this initial result suggested a gendered difference, a statistical test carried out on SPSS sought to clarify which factor was the highest determinant of scoring of each professional skill comparing; Age, Gender and Length of Industrial Experience. The results are shown in Table 2.

Table 2. Pearson's Coefficient analysis to identify correlations between scoring of skills and other factors such as Age, Gender and Length of Industry Experience.

	Character and Interpersonal Skills	Teamwork; Collaboration Skills	Communication	Excellence in Technical Skills
Gender	0.144*	0.128*	-0.004	0.145*
Age	-0.010	0.127*	0.045	-0.042
Length of Industry Experience	0.005	0.021	0.059	0.090

*Correlation is significant at the 0.05 level (2 tailed)

There were no correlations observed with regard to length of industry experience. A significant correlation was observed between Age and the importance of Teamwork and Collaboration Skills (Pearson coeff= 0.127 at the 0.05 level). The results also indicated that whilst there was no significant correlation observed between the overall average score and gender, significant correlations were identified between Gender and the importance of Character and Interpersonal Skills (Pearson coeff=0.144) Teamwork and Collaboration (Pearson coeff=0.128) and Excellence in Technical Skills (Pearson coeff=0.145), all at the 0.05 level.

Conclusions and Further Work

One aim of this survey was to consider influences on an academics' opinions on the importance of specific professional skills in engineering graduates of today. The study showed that gender appears to have a significant influence not only on the importance of all professional skills, but particularly in relation to the importance of pure technical skills over non-technical skills. There is evidence to suggest that an academic's experience in industry also influences their judgements on the importance of professional skills. This finding suggests that there is value in the proposed phenomenographic study and in particular to investigate differences in gender profiles of academic staff and their attitudes or approaches to teaching non-technical skills.

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