

Employability of Engineers Relative to Other Graduates

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Structured Abstract

BACKGROUND

This research is part of a project on graduate employability commissioned by the Office for Learning and Teaching (OLT). While there is general consensus that educational institutions aim for their graduates to be highly employable, there is contention about how this can be done and how to determine whether it is achieved.

PURPOSE

This paper identifies aspects of engineering education and the engineering industry that may account for differences in employment outcomes relative to graduates in other disciplines and fields of study. It is intended that a wide range of fields of study and fields of practice can benefit from identifying dimensions that influence employability. In particular, gaps in understanding, priority and terminology between industry and academics have been sought out for clarification.

APPROACH

Data from annual surveys has been investigated to identify distinctive aspects of employment for engineering compared to other disciplines. Views of industry professionals on the employability of graduates were collected at an industry forum. The forum included representatives of a range of disciplines including civil engineering. Similarities and differences of the views of employers of engineers in comparison to disciplines other than engineering have been investigated. The results are considered in the context of other stakeholders including academics, students, and graduates. The data were analysed thematically with a qualitative phenomenological approach. Data emerging was grouped together in terms of generic skills, employability and strategies to develop learning outcomes in undergraduates.

OUTCOMES

The research leads toward development of a framework for understanding and developing employability, in particular, contributions from the engineering industry and academic community. An understanding of how the various industry sector contexts impact on employment outcomes and by extension employability, is sought.

CONCLUSIONS

Many of the fundamentals of employability are shared across fields of study and industry sectors. Fields of engineering share some characteristics in terms of employment destinations for graduates and further investigation is required to best relate these to development of educational programs. The engineering profession and engineering educators have made a distinctive contribution to the way the employability of graduates is valued and developed. This distinctive contribution can play an important part in closing gaps in understanding and language between industry and academics and across a wide range of disciplines.

KEYWORDS

Employability, graduates

Introduction

One of the main purposes of higher education is for participants to gain employment but assessing the effectiveness of education in achieving this aim is a difficult task (Moreau & Leathwood 2006; Markes, 2006). The term “employability” has been used to describe this area of investigation

Employability has been used to encompass the achievements, skills, understandings and personal attributes that make graduates more likely to gain employment and be successful in their chosen occupations, which benefits themselves, the workforce, the community and the economy (Hillage et al., 1998; Yorke & Knight, 2007). Some definitions are more closely linked to programs of study, for example, “the benefit and usefulness of the study programme for career and work tasks” (Støren & Aamodt, 2010). The elements of employability include career development and learning, experience (work and life), degree subject knowledge, understanding and skills, generic skills and emotional intelligence (Dacre Pool & Sewell, 2007).

The rate of employment does not necessarily reflect the employability of graduates in particular fields (Little 2001). Economic conditions and the differing characteristics of employment and self-employment in industry sectors will also play a role in employment outcomes. The inter-relations of factors can be very complex, for example, one study found an engineering degree, in comparison to other fields of study, to be associated with high levels of self-employment in female graduates but not for male graduates (Leoni, & Falk, 2010). The employability of graduates in various fields of study are commonly investigated separately due to the distinctive differences of employment sectors (e.g. Male et al., 2010; Nilsson, 2010; Trevelyan & Tilli, 2010; Atkinson & Pennington, 2012). Some comparative data shows fields where graduates tended to be employed in areas closely related to their degree (engineering, education and nursing) had higher levels of employment (Coates & Edwards, 2011).

In this paper, data from Graduate Careers Australia is reviewed with the aim of identifying characteristics of the employment outcomes of engineering graduates in order to assist in unravelling the complex interactions that make up employability.

Background

This study is part of Office for Learning and Teaching (OLT) commissioned studies into graduate employability. This paper reports background investigations of engineering graduate employment outcomes to be built on by ongoing focus groups with students, graduates, employers and academics. Much of the data on graduate employment outcomes comes from annual surveys of graduates conducted by Graduate Careers Australia to investigate both educational experiences and employment outcomes. The survey is conducted approximately 4 months after completion of the program of study. Data on employment of graduates over 30 years indicates that economic conditions are a first-order influence employment outcomes (Figure 1). The fields of medicine and pharmacy have shown consistently high employment outcomes with low volatility. In comparison visual and performing arts has shown lower employment outcomes and higher volatility. It can be inferred that the highly structured employment and accreditation schemes in medicine and pharmacy together with the reliance of the community on these health services, lead to the observed employment outcomes. The relatively unstructured nature of casual employment and self-employment in the arts together with individuals pursuing their studies for reasons other than employment may explain the lower employment outcomes observed in visual and performing arts.

Graduate Careers Australia recognise eight fields of engineering education. The employment outcomes for these fields have been combined and are shown in comparison to

Figure 2: Distribution of fields of education in Graduate Careers Australia data for 2013 (GCA, 2014a). See Table 1 for key to selected fields.

Graduate Careers Australia also conduct a longitudinal survey of graduates to investigate trends in employment over time (Beyond Graduation Survey, GCA, 2014b). As indicated in the data, graduates in some fields of education with lower employment outcomes have increased their employment by 20% or more over three years (Figure 3). Graduates in engineering and related technologies were reported to increase employment outcomes by 10% (Figure 3).

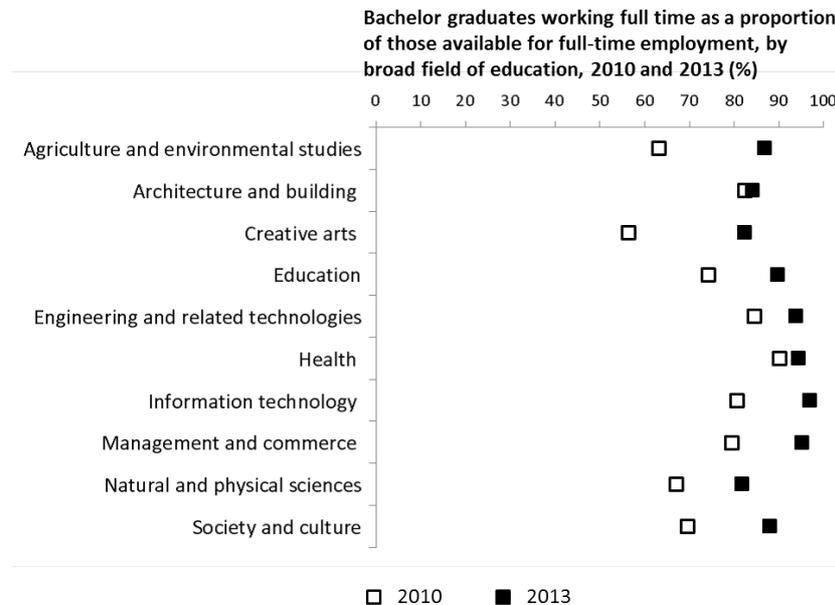


Figure 3: Longitudinal survey of graduate employment from 2010 to 2013 by broad field of education (GCA, 2014b). See Table 1 for key to selected fields.

Graduate Careers Australia also conduct a survey of organisations to investigate trends in employment (Graduate Outlook Survey, GCA, 2014c). This survey has been conducted over nine years from 2009-2013. The 2013 survey obtained 466 usable responses from employers based in Australia (93.6%), Asia (5.4%) and New Zealand (1.1%). The employers mainly represented the private sector (64.8%) but the public/government sector (24.0%) and not for profit sector (11.2%) were also represented. Organisations with 500 or fewer employees (55.8%) and organisations with more than 500 employees (44.2%) were relatively evenly represented. The survey findings are reported according to six industry sectors: Legal and Professional Services (26.0%); Government, Defence and Health (24.5%); Construction, Mining and Engineering (19.5%); Communication, Technology and Utilities industries (14.8%); Accounting and Finance (10.5%); and Manufacturing (4.7%). Each of these sectors has been found by Graduate Careers Australia to represent a relatively coherent set of responses during the life of the survey.

Current trends in graduate recruitment include a downturn over recent years attributed to economic conditions triggered by the global financial crisis (GCA, 2014). The Graduate Outlook Survey includes a question “would [your organisation] have employed a higher number of graduates in [year] if more appropriate graduates had been available”. The response to this question has fluctuated but has been noticeably lower (18% to 28%) over the last five years since the global financial crisis compared to the first four years of the survey (33% to 65%). Employers were also asked to indicate difficulty in sourcing graduates by discipline area. The top five disciplines in decreasing order were information technology, business & economics, health/social sciences, resource engineering/earth sciences and engineering (GCA, 2014a).

Characteristics of Employable Graduates

A recent forum of employers and representatives of professional bodies from computer science, engineering, life sciences, media and communications, and psychology included discipline-based focus groups discussing what employability meant in their organisation. Specific issues discussed were what skills and attitudes they look for in graduates, how they assess these skills in graduates, what they don't like to see in graduates and what is missing in current graduates. The detailed results of the forum will be published elsewhere, however it was noted that for all fields represented the points made could be summarised according to the Dacre Pool and Sewell employability framework (Dacre Pool & Sewell, 2007). No distinctive differences were observed between the fields of study represented at the forum. It was observed that personal attitudes featured very highly in the positive and negative characteristics discussed by participants.

Engineering Employment

As indicated above, the fields of engineering sit within the range of many of the employment outcome parameters. The employment outcomes are generally above average but are exceeded in a number of other fields. The Graduate Careers Australia data was investigated further to seek an attributes for which engineering was distinctively different to most other fields. Two aspects were identified: 1) the relevance graduates attached between the qualification and their work and 2) the proportion of graduates working for large organisations.

Relevance of Qualification

The annual survey of graduates asks for self-reporting on whether the qualification achieved is a formal requirement, important, somewhat important or not important (GCA, 2014a). While there is a wide spread of employment rates, a general increasing trend with relevance of qualification can be observed (Figure 4). It is interesting to observe that the eight engineering fields cluster within a range of 8% when formal requirement and important are grouped together (Figure 4). Few of the other fields lie in the same range (e.g. accounting, surveying) with a fairly even division of fields higher (e.g. education, health and law) and lower (e.g. sciences, business, humanities) on this criteria.

Relevance of qualification is a difficult parameter to interpret; it is possible that non-relevance indicates graduates unable to find work in their field however, it could also indicate graduates able to find work in fields beyond their qualification. Nevertheless, the data indicate that engineering occupies a niche within this dimension which can inform how engineering graduates prepare for employment.

Size of Organisation

The annual survey of graduates also asks for self-reporting on whether they are employed in small (2-19), medium (20-99) or large (greater than 100 employees) organisations (GCA, 2014a). A correlation between size of organisation and employment outcomes is not observed (Figure 5). However, the engineering field show some clustering except for mining engineering (96% in large organisations) and electronic/computer engineering (63%). Apart from nursing and medicine, five fields of engineering represent the highest proportion of employment in large organisations. The range of sizes of the employing organisation is a distinctive feature of industry sector. Some sectors with smaller organisations can sustain high levels of employment (e.g. pharmacy and dentistry). Within the engineering industry large organisations are supported by small to medium size enterprises such as specialist consulting firms. While it is difficult to interpret the impact of this dimension on employment of engineers, it is worth noting that most engineering fields occupy a distinct niche.

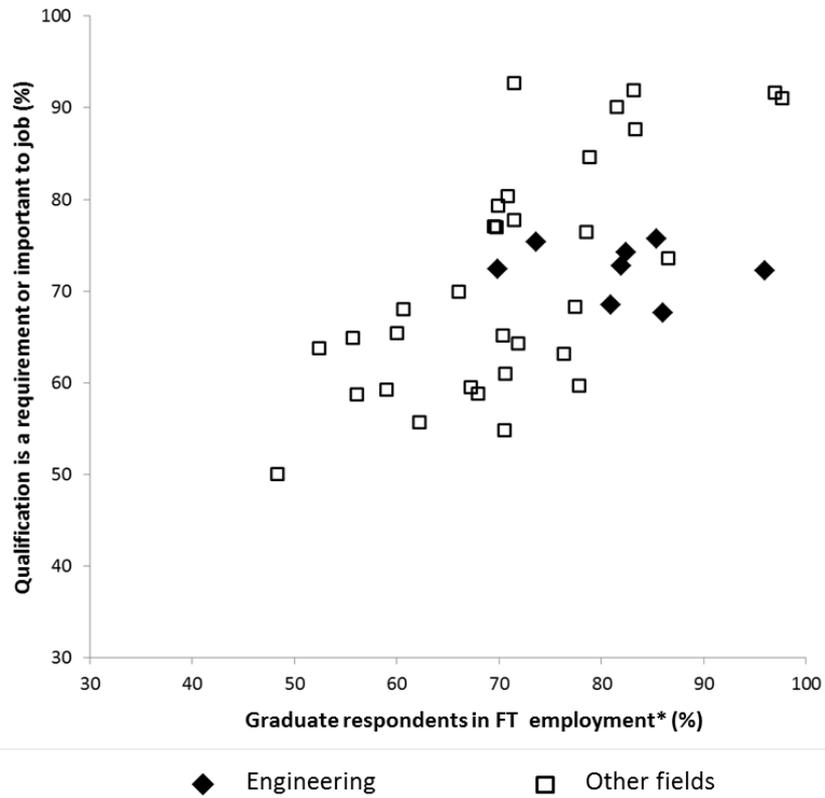


Figure 4: Relationship of relevance of qualification to employment outcomes.

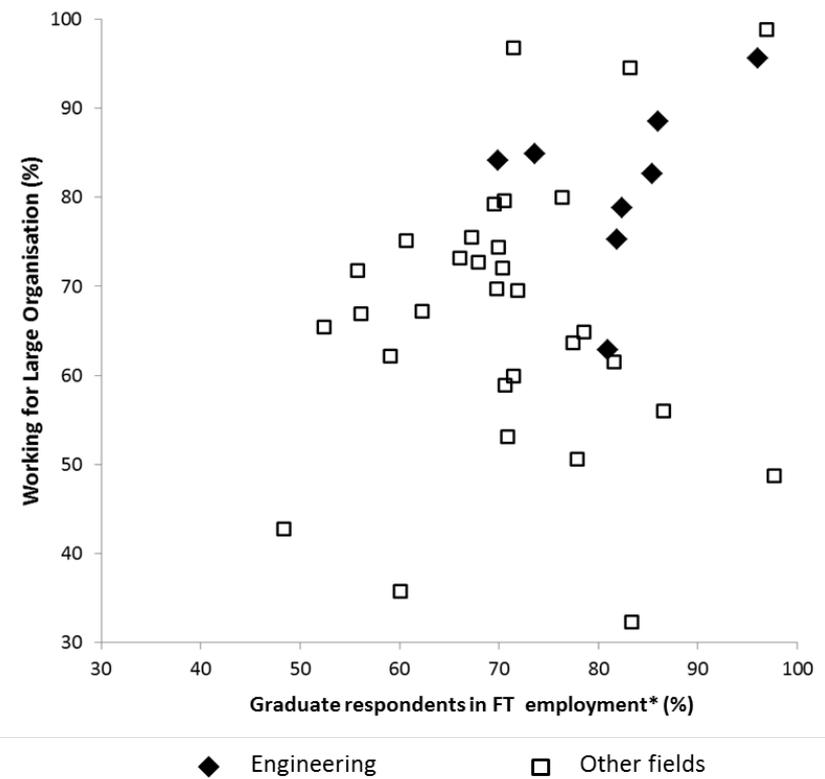


Figure 5: Relationship of size of employer organisation to employment outcomes.

Table 1: Codes for selected fields shown in Figure 1.

Code	Field/Occupation	Code	Field/Occupation
Ac	Accounting	P	Psychology
Ar	Architecture	Re	Rehabilitation
BS	Business Studies	SS	Social Sciences
Ch	Chemistry	SW	Social Work
CS	Computer Science	VPA	Visual/Performing Arts
E-I	Education - Initial	AE	Aeronautical Engineering
He,O	Health, Other	ChE	Chemical Engineering
Hu	Humanities	CvE	Civil Engineering
Ln	Languages	EE	Electrical Engineering
Lw	Law	ECE	Electronic/Computer Engineering
LS	Life Sciences	McE	Mechanical Engineering
Me	Medicine	MnE	Mining Engineering
N-I	Nursing, Initial	OE	Other Engineering
Ph	Pharmacy		

Table 2: Data for engineering fields in graphs in Figures 2, 4 and 5.

Field of Engineering	Employment Outcome (%)	Qualification a Requirement or Important	Large Company (%)
Aeronautical Engineering	78.6	72.4	84.1
Chemical Engineering	83.1	75.4	84.9
Civil Engineering	89.6	75.7	82.7
Electrical Engineering	86.7	67.7	88.5
Electronic/Computer Engineering	84.0	68.5	62.9
Mechanical Engineering	85.8	74.2	78.8
Mining Engineering	93.0	72.2	95.7
Other Engineering	86.8	72.8	75.3

Conclusions

Surveys of Australian graduates indicate that engineering fields cannot readily be distinguished from other fields of study on most criteria. Employment outcomes for graduates of engineering are generally within the high end of the range for all fields. An aspect where graduates in engineering fields are distinctive relative to other fields is in that the relevance of the qualification (formal requirement or important) to their work. On this dimension engineering fields were clustered around 72% ($\pm 4\%$) and only slightly overlapped other fields. Why engineering fields share this similarity and can be distinguished from fields which rate relevance higher (e.g. education, health and law) and lower (e.g. sciences, business, humanities) is not known. However, this observation is expected to be relevant to employment outcomes and the meaning of graduate employability within the industry sector.

The engineering fields (except for electronic/computer engineering) were also found to occupy a distinctive place with a high proportion of graduates working for large organisations. This observation is also expected to be relevant to employment outcomes and the meaning of graduate employability within the industry sector.

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