

Engineering Technician students: do they understand their future role?

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Abstract: *Two studies undertaken during 2010 reported on the characteristics, motivations and career aspirations of engineering students in Diploma, Advanced Diploma and Associate Degree programs at universities and Vocational Educational and Training (VET) institutions around Australia (Dowling 2010a, 2010b).*

This paper presents a qualitative analysis of the responses to one open-ended question included in the studies, exploring student understandings of the role of Engineering Technicians. These understandings were cross referenced to the age, work experience, type of qualification being studied and career aspirations of the students.

From their responses, it appears that few, if any, of the students are familiar with the role definitions prepared by Engineers Australia. They had a very superficial level of understanding of the role their qualification was preparing them for, with some depth only emerging predominantly from those with work experience. The paper concludes with a discussion on the implications of the findings, and highlights the importance of the need for clarity and consistency in job descriptions and promotional activities across the industry, particularly by educational institutions.

Introduction

The results of two studies were published during 2010, with both reporting on the characteristics, motivations and career aspirations of engineering students in Diploma, Advanced Diploma and Associate Degree programs at universities and VET institutions around Australia (Dowling 2010a, 2010b). Less than 16% of the students in each study reported that they have a career goal of working as an Engineering Associate (also commonly known as Engineering Technicians or Officers), the role their qualification was preparing them for. Just over half of the students are using their current program as a step on their educational pathway, as they aim to undertake further study and work as a Professional Engineer. The fact that the remaining 30% do not plan to work as an Engineering Associate has undoubted implications for engineering workforce planning. These findings, together with the continued growth in Associate Degree enrolments throughout Australia, stimulated the need to consider the reasons for this outcome.

This paper presents a qualitative analysis of the responses to the first of two open-ended questions included in the studies: exploring student understandings of the role of the Engineering Associate; and the role of the Engineering Associate compared to other members of the engineering team.

The first study was based on 247 responses to an online questionnaire (Q1) for students studying an Associate Degree in Engineering at the University of Southern Queensland (USQ) over the period 2006 to 2009. The second study, which built on and extended the first study, gathered 347 responses to an online questionnaire (Q2) from students enrolled in Diploma, Advanced Diploma and Associate Degree programs at nine institutions (university and VET) across Australia during 2010. Since graduates from both Advanced Diploma and Associate

Degree programs are eligible to apply to Engineers Australia for membership and recognition as Engineering Associates it was hoped that the Australia wide study would confirm or extend the generalisability of the findings from the single institution, single qualification study.

Methodology

Both questionnaires were delivered online, with lecturers at the respective institutions requesting the co-operation of the appropriate cohorts of students. Ethical consent had been obtained, and anonymity was guaranteed for the students. Details of questionnaire administration and response rates are contained in Dowling (2010a, 2010b).

The Q1 responses indicate that the vast majority of students were studying part-time by distance education and working full-time in the engineering industry. This was in contrast to Q2, where approximately half of the responses were from one dual sector institution and, as noted in Dowling 2010b, these were predominantly full time students in their first or second year of study.

The open-ended questions in Q1, delivered only to students who were studying the USQ Associate Degree, were framed slightly differently to those modified for use in Q2 which needed to consider both Advanced Diploma and Associate Degree students and be worded appropriately for students from a range of institutions. While the intent was the same, nuances in meaning may have altered the perspective of those answering. The open ended questions relevant to this paper were:

- Q1: Based on observations to date what is your understanding of the role of an Engineering Associate?
- Q2: Based on your observations to date, describe the role of an Engineering Technician (sometimes called an Engineering Associate or Engineering Officer)?

Results

The open-ended questions being considered in this paper were embedded in the body of Q1, whereas they appeared at the end of Q2. Approximately 55% of the Q2 respondents did not answer the open ended question, or answered with the words “*don't know*”. This lack of response may have been due to the length of the questionnaire, or their lack of confidence or knowledge or their resistance to putting their understandings into words. Work experience, or the lack of it did not seem to affect the response rate for the open ended questions as approximately half of those who left the open ended question blank had worked in an engineering field. A higher response rate was received on the open ended question on Q1 with 215 responses, but 39 of these responses were either “*don't know*”, “*unsure*” or demonstrated the respondent had misinterpreted the question.

An analysis of the responses revealed that 14 of the 145 students who responded to the open-ended question had directly copied their text from an internet site. Such plagiarism cannot be assumed to provide valid information so these responses were not considered in the discussion of the findings. It was noteworthy that all of the plagiarised responses came from students with no prior work experience. A valid response was deemed to be a unique response which attempted to define the role of Engineering Associate, however brief, but did not include those who replied with “*don't know*”, or “*unsure*”.

Demographics

There were 176 valid responses from Q1 of which 90% were from off-campus, distance students. The composition of the Q2 respondents (n= 347) included 50% from one dual sector institution, 23% from the Higher Education sector (3 universities) and 28% from the VET sector (5 institutions) with approximately 22% studying off campus. Table 1 shows a distribution of the 131 students who provided a valid response to Q2, by type of institution, and current study program. Note that approximately one third of the respondents from the dual sector institution did not provide a valid response to the open ended questions.

Table 1: Institution and current qualification for students who provided a valid response

| Current Institution | Diploma | Adv Diploma | Assoc Degree | Grand Total |
|---------------------|---------|-------------|--------------|-------------|
| Dual-sector | 1 | 36 | 14 | 51 |
| University | | | 40 | 40 |
| VET | 17 | 19 | 4 | 40 |
| Grand Total | 18 | 55 | 58 | 131 |

If the responses from both questionnaires are combined it becomes evident that two thirds of the combined sample of 307 responses have come from off-campus, distance education students. The majority of on-campus students were less than 24 years of age and in their first two years of study, while the distance education students were spread across the age range with the largest group being in the 30-39 age category (Dowling, 2010b).

The role of an Engineering Associate

For those students that provided a valid response, two themes dominated their descriptions of the role of an Engineering Associate. The first theme was the definition of the role in terms of its relationship to others in the engineering field, almost always in terms of its relationship to professional engineers. Approximately 60% of the responses included language such as “assist”, “help”, “support”, or “work under”. The second group of descriptions, also approximately 60% of the responses, included an attempt to define the role in terms of the work done, usually from personal experience. There was some overlap between these themes. The only other theme that emerged was from a very small group (less than 5%) who saw the role of the Engineering Associate as a step in their career path.

It is useful to consider the major themes in more detail – remembering that in an online questionnaire such as this, the responses are likely to represent “gut level” or “off the top of the head” understandings rather than the type of well considered answers that might be presented in another context such as a written assignment.

1. The role of Engineering Associate defined in terms of relationship to others

Responses which appeared to define the Associate role in terms of its relationship to others were able to be grouped loosely around “assistance”, “providing support” or “working under”. A high proportion of the responses were quite short, bald statements that the Associate’s role was to assist the professional engineer or work under their supervision, although there was the occasional acknowledgement that this assisting role was valued. Some examples were:
“Assist in day to day aspects in an engineering environment”
“Associates are a support role. They provide valuable assistance to Professional Engineers”

Other responses referred to the higher qualifications of engineers, for example:

“My role is to assist the more highly qualified and perhaps more experienced engineers....”

Working under supervision was another aspect commented on, for example:

“An Engineering Associate is generally supervised directly or indirectly by an engineer”

The assistance provided by the Associate was described as technical support, particularly with specialised knowledge, for example:

“I provide a support role to my supervising engineer by being responsible for dealing with day-to-day engineering matters. I investigate, compile, analyse information and produce engineering reports for various water supply and sewerage servicing activities”

Working with engineers, but lacking the power to sign off and ultimate responsibility, was a recurring theme, for example:

“Does not have the responsibility of being a professional engineer (everything is signed off by an engineer)”

“An engineering associate has the knowledge to complete a large portion of day-to-day engineering, however is required to have a manager check and sign off”

The “middle man” role between the professional engineers and management and trades people was an aspect that was also recognised, for example:

“Often the interface between the shop floor and the engineers”

Some responses, all from students currently working in the engineering industry, provided a negative view of this supportive role and their status on the engineering team by using phrases like: *“doing the GRUNT work of the Engineer”* *“Support my engineer with all the boring bits”*, *“be the arms and legs”*, *“worker bees”*, *“do the dirty work”*

2. The role of Engineering Associate defined in terms of the type of work done

The second major categorisation of the open ended responses was the definition of the role in terms of the type of work done by the Engineering Associate. Usually appearing to speak from personal experience, these responses illustrated the potential diversity in the range of tasks, often specific to one engineering discipline or field. The practical or *“hands on”* role played by the Associate was recognised by the majority of these responses, often contrasted with the more theoretical orientation or education of the Professional Engineer. Generally these were from people with more than three years experience, for example:

“We are the worker bees in an office, doing work that is of a important nature but very practical. We don't generally delve into the theoretical areas that Professional Engineers work in”

“Engineering Associate is involved with the design, drafting and implementation of projects. They are often in a more 'hands on' position with regard to the project design than engineers”

Design featured very strongly in the descriptions of the role of the Engineering Associate, but the role varied. Forty one of the Q1 respondents described their role in terms of drafting documents and the preparation of working drawings. For example:

“Help to estimate costs, prepare specifications for materials and carry out surveying and drafting.

“Use computers to produce designs, detailed drawings and documentation

“Engineering technicians crunch the numbers and provide the design documentation, whereas the professional engineers provide client liaison and design certification”

Some students, especially those with personal experience, recognised that an Engineering Associate could well hold a supervisory or project management role. The level of responsibility and autonomy was dependent on experience, and the size and location of the company or organisation. For example:

“In my organisation the role of an engineering officer is a management role, which involves planning of projects and supervising their construction/ installation.”

“Assisting with project management tasks and eventually working as project manager, conducting site inspections”.

“In my field (Civil) the role of an Engineering Associate includes but is not limited to the design and drafting of projects, ... depending on the size of office and how it is structured they will also deal with clients, write reports and do some of the roles a Profession Engineer will usually do”.

3. The role of Engineering Associate defined as a stepping stone or career path

Only a handful of responses defined the role in terms of a stepping stone or career path, and all but one were studying an Associate Degree at a University.

“No idea there was a job as an engineering associate. Am studying to become an engineer, with the full desire to complete a bachelor study“

“To me its just a qualification that I need so I can step up in work”

4. Lack of understanding

What was disturbing was the previously referred to number of responses which were *“don't know”* or *“unsure”*. These students were undertaking at least two years of study, and as some of them expressed, they did not seem at all clear about the role they might expect to undertake after graduation. For example:

“This topic has not really been addressed too well so far

“I do not have a clear understanding of the differences and have always found it hard to find the information regarding the role that would be expected”

Differences in institutional responses

The universities only offered Associate Degree qualifications and the majority of responses were from part time, distance education students, many with work experience. The responses from these students evidenced their greater experience and ability to articulate the role of the Engineering Associate in some depth, for example:

"I would expect an Engineering Associate to have relevant skills and abilities to support Professional Engineers in the workplace. Tasks involving basic design, analysis, report preparation, site inspection, drafting, understanding of codes, ability to find required information and continue professional learning development".

By contrast, the dual-sector cohort had a higher proportion of students with little or no work experience. Consequently their understandings of the role of an Engineering Associate were not well formed and they often described the role at trade or hands-on levels, such as:

"Component level repairs and construction, fault finding, basic programming".

"An engineering technician is a person who knows how to build and repair equipment".

The majority of the students from the VET sector who responded to this question had some work experience in the engineering industry, and they provided quite insightful responses, often suggesting that they saw the role of Engineering Associate in quite a positive light.

"I see the role of an engineering technician as a person who is able to design, oversee construction, liaise with all stakeholders, etc, but would not be in the position of responsibility as an Engineer would be. I see the technician often carrying out work on behalf of, or as requested by, the engineer".

Differences relative to years of experience

Approximately half of the respondents who had employment experience provided valid responses to the open ended questions and there was a noticeably higher proportion of in-depth responses in this group, presumably because of their experience. In the Q2 sample, only 48% of the students who gave valid responses had worked in the engineering industry, compared with 66% of the respondents in the Q1 sample. Of those with no employment experience in the engineering industry a much higher proportion stated "don't know" or "not sure" and even when responding, the majority of their responses were superficial or extremely brief. For example:

"An engineer tech from my observations is in charge of looking after equipment and stuff"

"A step below Professional Engineer. Can do the calculation but cannot sign off the work"

Some in the 'no work experience' group recognised their lack of knowledge of the role.

Comparison with Engineers Australia's definition

The Engineers Australia guide to the Stage 1 Competency Standard for Engineering Associates uses very positive language in defining the role of Engineering Associates (see Engineers Australia, 2011, pp37-38). Engineering Associates *"focus mainly on practical applications."* *"They may be expert in....one or specific activities"* and are *"often required to be closely familiar with Standards and Codes of Practice, and to become expert in their interpretation and application to a wide variety of situations."*

The document does not emphasise the role of the Associate to "assist" the Professional Engineer, rather couching the support role as *"many develop extensive experience of practical installations and will be more knowledgeable than a professional engineer or technologist on detailed aspects that can contribute very greatly to safety, cost or effectiveness in operation"* and Engineering Associates *"often develop detailed practical knowledge and experience complementing the broader or more theoretical knowledge of others."*

Engineers Australia acknowledges that there is a lack of understanding about the role of the Engineering Associate and is promoting the role *"as making a vital contribution to the engineering team by applying established codes, practices and procedures"*. The following paragraph is of particular note: *"The competencies of the engineering associate equips them to certify the quality of engineering work and the condition of equipment and systems in defined circumstances, laid down in recognised standards and codes of practice....Such certification*

should be fully acceptable in the public domain and should not require further endorsement by other practitioners perceived to be more highly qualified.”

This contrasts with the emphasis placed by a high proportion of respondents on the perceived requirement for a Professional Engineer, rather than the Engineering Associate, to “sign off” on engineering projects or tasks.

Engineers Australia identifies that one of the key differences between Engineering Associates and Professional Engineers is that while Engineering Associates apply “*established technical and practical methods to the solution of **well defined** engineering problems*” Professional Engineers apply “*established engineering methods to **complex** engineering problem solving*” (emphasis by authors). The aspect of complexity was identified by some of the respondents: “*Engineering Technicians perform **less complex** tasks in the order of maintaining equipment/structures/vessels while still contributing to the design and manufacture. Project management can vary from complete control to little or no control at all*” “*Engineering technicians will undertake a number of duties which are **less complex** than that of an engineer.*”

Although they may not have used the phrase “well defined” as in the Engineers Australia guide, some respondents did recognise that Associates operated within a very specialised engineering knowledge and skill set. For example (emphasis by authors):

*“A professional and qualified person ... specialising in a certain field of engineering with knowledge and skills to provide a **specific and precise** service to the industry in which they are involved.”*

*“The role of the Engineering Technician is to support engineers giving solutions to more **specific problems** within the design process. While engineers take **broad and final** decisions, technicians develop design, alternatives and solutions for those problems”.*

Conclusion – Where to from here?

The responses from the two online questionnaires show few, if any, of the students were familiar with the role definitions prepared by Engineers Australia. They had a very superficial level of understanding of the role their qualification was preparing them for, with some depth emerging predominantly from those with work experience. The majority of the students, particularly those starting out in their qualification, also perceive there is a lack of status in the Engineering Associate role; they see the role as one of support or assistance rather than one of pride, value, and independence. The prevalence of references to the lack of responsibility for initial design decisions, “signing off”, planning, and project management was such a dominant theme throughout these responses, that the lack of enthusiasm for the role of an Engineering Associate as a career goal seems a logical consequence.

It is recommended that the institutions offering programs for Engineering Associates should ensure that both commencing and prospective students understand the role and the potential for career pathways for the Engineering Associates. It is also recommended that Engineers Australia and employers should review the work profiles and career options of Engineering Associates to make them more attractive and rewarding.

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