A Technician is Half an Engineer – Overseas Students and Advanced Standing in Engineering Degrees

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Abstract*: This paper presents a discussion of the curricula issues associated with the current contextual issue of competition between Universities for overseas students, the desire of prospective overseas students to save money through minimization of the time spent enrolled in an Australian university, and the expectation of significant advanced standing to be granted on the basis of completion of a diploma level qualification. The author's interest in this issue follows from involvement in marketing activities, and responsibilities as a Program Director.*

Keywords*: curriculum, advanced standing, overseas students*

Introduction

Australian engineering degree programs are four year awards recognized by Institution of Engineers Australia, IEAust (IEAust, 1999) as the academic basis of the status of engineer. Industry requires diverse qualifications ranging from unskilled labor to postgraduate qualifications. Most Universities educate only at the Bachelor degree level and above, and TAFE and others train at the lower levels.

The Dawkins policy (Dawkins, 1988) emphasized efficiency in Australian education through, *inter alia*, provision of program articulation allowing upgrading from paraprofessional to professional status with minimal, or zero, time loss compared with standard entry degree education. Dawkins' policy was predicated on the view that such a transition is 'efficient' for both the government and students.

Dawkins' view of curriculum

Dawkins (Dawkins, 1988) regarded the levels of professional recognition as stepping stones along a single path, seeing the various professional levels as different exit points in personnel development. But in engineering a technician is not an engineer who knows a bit less, but a person involved in the practical work of building unusual systems, requiring more than process and trade skills, system and factory maintenance. Engineers conceive, architect, analyze, and effect all the system life cycle processes. The skills of technicians and engineers are different, demanding different educational strategies (Harris *et al*, 1995). Thus, good technician education, traditionally the Associate Diploma, is not a shortened Bachelor of Engineering, but is different in kind, and thus raises an objection to Dawkins' curricula assumptions.

Another issue in program articulation concerns overseas students, and globalization of education (Kelly, 2000). Long ago overseas students studied their entire program in the Australian university. Many students now study an engineering related diploma at a homeland college before coming to Australia to 'finish' their degree. The student and parental expectation is that the total study time taken to 'finish' their degree will be the same as if they had only studied the whole degree. The expectation of zero time penalty for taking a two stage education is reinforced by the offer of advanced standing entry that appears to enable graduation in a total study time that appears to be standard. Competitive effects in the overseas student market results in prospective students favoring the universities offering the most advanced standing.

Issues about advanced standing

Overseas students from some countries and source colleges perform better than others under existing advanced standing arrangements. This observation raises the following questions:

1. What does advanced standing assume?
2. Do students at college *Y* learn what we think they learn when studying a course with a particular course statement?
3. Does 'English medium' instruction result in good English language study skills?
4. Is technician diploma education the start of an engineering degree, validating the idea of 'finish' the degree in Australia?
5. Does the diploma teaching and learning, T&L, culture transfer well to an Australian degree?

Advanced standing assumptions

The advanced standing determination process for holders of the Diploma in *X* Engineering from *Y* College mapping to the Bachelor of Engineering in *X* relies on the Program Director obtaining *Y* College program documentation and comparing the course statements in both programs. The assumptions:

1. That engineering education can be modularized into a set of courses which, when summed, result in output of one whole engineer. The modularization assumption yields flexibility for purposes such as part-time study, progression of weak students and granting of advanced standing (Betts and Smith, 1998). The process depends on the *Y* College documentation.
2. Many engineering academics regard, at least tacitly, certain content as essential in education and that concept titles are unambiguous. Thus, the interpretative issue is not that *Y* College and the University mean different things by a topic name, but that what students have really learned as a result of a course is different than we think based on our reading of the syllabus. The danger of this trap increases in engineering because of the standard terminology and common necessary content assumptions (Toohey, 1999).

Coursewise mapping

The decision to grant advanced standing for study in a related diploma is based on content similarity in the courses compared. This approach is based on the assumption that content is paramount. University of South Australia course statements are required to state the Graduate Qualities developed through study of the course, and a statement of the teaching means. Other institutions' course statements may or may not include this information, and where it is included the interpretation is not as transparent as statements of engineering content. Malaysian college documentation includes such information because of government requirements. In any case, the grant of advanced standing is not based on the broader information because the practical belief is that advanced standing denial may only be based on content because of the view that assessment tests in relation to content. Lying behind these beliefs is the discipline emphasis on information, content, transfer, as the T&L means, and the lack of emphasis on the T&L environment in engineer formation.

Observation of performance of students from certain overseas colleges suggests significant flaws in the above advanced standing approach. High performing students, at diploma level, may suffer significant lack of performance. This outcome is bad, and indicates that too much advanced standing was granted to enable the students to transition into degree studies well, particularly with the T&L context and lifestyle changes required simultaneously.

The transition to study and life in Australia, apart from family and culture is traumatic, causing many students difficulty. The personal transition problem is compounded by the fact that many overseas students arrive in Australia a few days before term begins or, often, after classes have commenced (Kelly, 2000). Just-in-time arrival compounds the adjustment problems because students must simultaneously adjust lifestyle and catch up study in an unfamiliar system.

Overseas students must adjust to an unfamiliar education system (Biggs, 1997). The system difference arises from the change of country, general educational culture issues and the jump from a diploma to the middle of a University degree, in a system that encourages originality, initiative and independence. Skills related to these qualities are not directly taught by certain courses but are conveyed through the T&L environment and assessment methods, the broader aspects of curriculum, in the Australian university environment, through process encouraging students to question teachers and to explore through project based learning. These capabilities, distinguishing them from the mechanistic connotation of competencies, underlie success in an engineering degree but are not necessarily developed in courses mapped by a content oriented advanced standing process. The capability development difference resulting from the different purposes of diplomas and degrees in engineering and the different institutional context (Ratcliff, 1997). Professional engineering practice requires the greater capabilities developed in the degree (Little *et al*, 1998).

The effect of these differences is that the learning outcome is different than that gained by the Australian degree students. The difference matters in advanced standing because advanced standing is given for early year courses, and requires students to enter the degree program at a higher level, and to do continuing studies. This has the effects of telling the student that they know what is required about the early topics, and enrolment is in classes we have acclimatized to our, different, expectations. It is not surprising that the experience is traumatic for many, and results in lower academic achievement than many students expect.

English medium

Many overseas colleges use English medium instruction but in diploma level colleges most staff are of local origin and fluent in local languages, so classes are conducted in English, satisfying the English medium requirement. It is plausible to believe that some discussions of material are conducted in local language shielding students with weak English from the full consequences. It is also easy for linguistically weak engineering students to retreat into learning equations thus incompletely understanding the material. Rote learning of equations provides success in a technician qualification, aimed to train for work in a constrained space but the expectation of engineers to apply concepts to create new technologies demands abstraction and understanding that requires integration of the quantitative and qualitative. Development of the professional skill of engineers demands students understand the instruction medium deeply enough to develop abstract understanding of the content. In contrast, the equation learning approach reduces engineering to declarative and procedural skills and loses the technology creation skills (Biggs, 1999).

It follows that by the halfway point of an engineering degree, students are assumed to have a profound academic facility in English. Students who commenced their degree studies with normal entry have had the advantage of about two years to develop their understanding of the vocabulary and communication methods of engineers.

'Finish' the degree in Australia

The growth in opportunities for technical education in many student source countries has led to many students seeking to commence their post-secondary studies at home with a view to 'finishing' their target, professional, qualification overseas. Factors contributing to this include convenience and cost, and because of the solid packing of 'semesters' into the calendar year in some countries, time. Students attracted to the $x + y$ years approach to qualification tend to be those either from less wealthy families or of lower ability, reducing the risk inherent in each step. Thus, students not able to enter a local university seek first to train as technicians, and then to immediately continue studies for an engineering degree, without loss of time. The assumption made by the students, and their financial supporters, is that the diploma is the first stage of a degree.

This assumption reflects a lack of understanding of the different nature of engineering and technician level responsibilities, and the fact that a different kind of education, not just a different quantity, is required.

Teaching and learning culture

The T&L culture has three aspects, being national; discipline; and educational level. The most commonly discussed form is the national T&L culture manifestation, discussed because awareness of it arises from globalization of, *inter alia*, education.
Globalization is seen in 'internationalization' of curriculum, often in a gloss attempting to show the curriculum addresses overseas student needs, largely as part of the recruitment marketing process (Kelly, 2000, Slaughter and Leslie, 1997). Kelly argues that many lecturers have not analyzed diversity issues in their discipline and so cannot teach a genuinely international curriculum. Therefore teaching method and content are not deep responses to the difference in national culture, and resulting problems are often blamed on students (Biggs, 1997). This is bad because overseas students express their high valuation of Australian education in the price they pay to obtain it. Biggs used this observation to attack the stereotype of Confucian culture students as only wanting to be rote learners, with support from a case of Problem Based Learning in Hong Kong, concluding that the students learned new habits and enjoyed exploratory learning, and performed well in the constructivist learning paradigm. Biggs cited a study of Singaporean students in Australia who began with a 'follow the teacher' style, but later demonstrated greater excellence in pursuit of higher

learning goals than the Australian students. These examples demonstrate the error arising from misunderstanding the Confucian view of education.

I question Biggs' conclusion of high valuation of Australian education, based on marketing experience in Malaysia. Inquirers' main questions relate to the price, the duration and Malaysian accreditation. This combination of questions suggests that the value of Australian education is the career value of graduation, and that education is seen as a commodity with a useful personal outcome. This is also seen in the lack of personal goal clarity. [I recall one conversation, May 2002, Subang Jaya. An inquirer asked whether it is better to study engineering or computer science. I answered with a question, essentially, "What do you want to be?" The inquirer appeared to have no answer to this personal ambition question.] Most inquirers I have met in South East Asian countries have, for educational or political reasons been unsuccessful in entering local universities, and so look off-shore as their means to their desired qualification.

Also, contra Biggs, one may observe a different perception of educational activities in life that is clearer to western background people in Confucian origin students. The following transcript involving two Malaysian students in Holland appears in Rasker's PhD concerning their performance in a research activity.

D: Well I expect a bouquet.
O: At least.
D: So, this was not the last time.
O: No, apparently not.
D: Maybe, this evaluating conversation is also important.
O: Yes, they need that on tape also.
D: I don't think we've said anything interesting.
O: I don't think so either.
D: Well, say something crucial.
O: It is going outstanding.
D: So his thesis will be more thicker.
O: Yes, exactly.
D: I can say something in Malaysian so they have to consult all sorts of dictionaries.
O: Okay, go on.
D: (…)
O: (…)
D: There comes another round.
O: Yes! (Rasker, 2002, pp 103,104)

This conversation contrasts with those of the other pairs in Rasker (2002) who discussed the activity but not its relation to education. The conversation above suggests a disconnect between work in an educational setting and in professional practice. The problem for the teacher is to develop educational activities that will be approached with professional realism. Ethnic culture influences epistemological beliefs concerning the nature and means of obtaining knowledge. The difficulty is that people are not usually aware of their cultural assumptions because those assumptions and their consequences are seen as the natural way to perceive, too deeply held to be recognized and made amenable to questioning (Joseph, 2000). Overseas students need guidance to deal with the contrasts between the Australian and their own intellectual cultures.

The discipline cultural issue seems odd to raise in relation to advanced standing within the same discipline. We first observe that the T&L cultures of disciplines are different (Rickmeyer, 1990). The difference experienced by students changing disciplines results from both the discipline change and the diverse teaching methods of schools within universities.

So, in transition between institutions, the student will find a significant change of T&L culture. The T&L culture change is greater when other divides are also bridged, which in engineering may involve a change of the industry around the university.

The diploma to degree transition also requires students to move from a program designed to form technicians to one forming professional engineers. The technician diploma aims to train a person to competently perform routine intra-discipline tasks. A good diploma program may emphasise repetitive drills, and the process to perform certain tasks. Such a training program does not develop professional engineering skills as described above (Little *et al*, 1998).

In contrast, developing skills to enable taking professional responsibility in the engineering degree requires a different kind of knowledge of the material that enables application to new situations. The traditional approach of engineering education, at least since the 1950's, has been emphasis on fundamental principles. For example, an engineering degree may teach the mathematical equations describing microwave propagation, but not teach how a microwave oven operates. The technician would learn to describe why the microwave oven works, but not the equations.

Advanced standing – TAFE case

In the case of graduates of Australian TAFE Associate Diplomas it has been a practice in some universities to grant something approaching two years' advanced standing, but to not provide credit in maths, because the TAFE program has trained students to entry standard maths. This is a response to the Dawkins policy (Dawkins, 1988). The problem raised by this approach is: is an engineer a technician who has studies a bit more maths? This approach to advanced standing implies that the mathematical approach used in circuit analysis in the first two years is not necessary because the TAFE graduates can get by with only algebraic formulation of those courses. This undermines the argument for using an advanced mathematical perspective for standard intake students.

The argument for advanced maths in engineering degrees parallels Plato's argument for the study of geometry, 'that it enlarges the ability to think about problems' (Plato, 1888). Maths is seen as mental training and as a good tool for analysis of physical stuff. The advanced standing approach taken in TAFE to degree upgrading implies the assumption that the skill associated with knowledge of maths will be transferred to analysis of systems originally studied using algebra. This assumption is weak because in general students are poor at transferring generic skills learned in one context to another (Savin-Baden, 2000). Another problem for upgrade students is that many studied diplomas because of insufficient school grades to enter a university engineering program, with maths often being a major part of the deficiency, so students with a history of difficulty with maths are expected to transfer maths knowledge to analysis and modeling of tangible things.

It is often observed that diplomates with industry experience often perform well under advanced standing arrangements. The experience is important because the candidate has seen the value of being an engineer. Also, mature age students are personally mature, and aware of their sacrifice to study, and so have a greater work ethic than school leavers.

Degree coherence

The professional level skills expected of a graduate engineer are expressed in the IEAust accreditation manual (IEAust, 1999). Some of the skills relate to technical knowledge, but most of the qualities required for accreditation relate to broader skills, such as ability to take a systems perspective, communication, and other skills linking knowledge to social, environmental and political issues. These skills are not developed by a simple add-on from a diploma, by adding courses in these matters. A coherent degree should develop the student in all the necessary qualities in a balanced manner through the program.

Where some students are granted advanced standing, the progress in development of abilities and qualities is changed and the degree becomes a different award for the various classes of graduates. The design of a coherent degree for normal entrants is difficult (Ratcliff, 1997), but when added to the problem of advanced standing appropriate balance is exceptionally difficult to achieve.

Conclusions

Students entering an engineering degree with advanced standing based on having a technician's diploma may complete the requirements for the award of a degree in engineering. However, the capabilities of such graduates are different than those possessed by normal entry students. The difference in capabilities relates to the student's perception of the approach to the analysis of engineering problems and the ability of the student to create novel solutions to problems. The difference is likely to remain within the bounds of personal variation between students, as some enter with a greater capability to take a holistic view of the work, whereas others take a narrow view of engineering as a manipulation of technical things.

The particular problem of overseas students entering with advanced standing is that they are shaped by their background diploma level training, which narrows their perception of the nature of engineering to implementation within the discipline, and increases their difficulty in achieving success because the range of adjustments, both personal and academic which they must make on arrival is very great, and increased by entering the degree at a level with students who have already learned how to study in the university setting. A major difficulty is that their background gives them knowledge of similar content, but taught differently, and inculcating different learning strategies than normal entry degree students have experienced by the time they arrive at the same stage of the degree. The result is that many have severe adjustment problems on arrival, which would be relieved if they were to study degree type courses throughout.

It is unreasonable to consider advanced standing entry into an Australian engineering degree as 'finishing' an engineering degree based on an initial stage of a technician's diploma overseas.

The observation that Australian diploma to degree upgrade students have better progress indicates that investigation of the possible benefit of work experience in the development of overseas candidates would be in order. This leads to speculation of possibilities such as linking the amount of advanced standing to suitable work experience. Such a policy would indicate a formal acceptance of the proposition that the work experience, performed in the informal structure of the work that the candidate obtained, is an important part of the engineer formation curriculum. Incidentally, the work experience would enable the candidate to satisfy the IEAust (IEAust, 1999) requirement for work experience as a necessary element of engineering education required prior to graduation.

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