

Contemporary Surveying Education and the Surveying Profession

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ABSTRACT

The authors recently prepared a report for the Council of Reciprocating Surveyors Boards of Australia and New Zealand (CRSBANZ), which concerned various matters relating to the surveying degrees whose graduates should be accepted for enrolment as candidates for registration with one of CRSBANZ's member boards. The more substantial part of the report involved a proposal for the minimum content of such a degree. As well, the report looked into some other issues associated with surveying education, including a consideration of the current viability of surveying degrees across Australasia. This paper explains the authors' logic in nominating the degree content and some of the more interesting aspects of the problem of nominating crucial degree content in the modern era, and then provides a short discussion of some of the more intriguing side issues, notably the current extent of the use of online material in education, the ambiguous mechanism of selecting cut-off scores for various courses, and the ultimate impact of surveying research on the education and the number of surveying graduates, assuming that the issues about university education may not be familiar to the surveying profession.

KEYWORDS: *University degrees, surveying education.*

1 INTRODUCTION

In late 2012, the authors prepared for the Council of Reciprocating Surveyors Boards of Australia and New Zealand (CRSBANZ) a report into various matters relating to those surveying degrees whose graduates would be accepted for enrolment as candidates for registration with one of its member boards. That report consisted of, primarily, a proposal for crucial university degree content, especially in the current era as technology changes and, secondly, comment on a number of other related educational issues which are seen to affect surveying education. The preparation of the report forced the authors to think seriously about various matters relating to current surveying education. Having gone through that process, it seemed worth sharing with the wider surveying community the authors' thoughts on some more interesting matters, especially as a number of the issues would be unfamiliar to people outside academic circles. More than that, the authors accept some responsibility to disclose and defend both their proposed course content and the logic used to prepare that list. The boards which have membership on CRSBANZ are those statutory organisations that register surveyors across all Australian states and territories and New Zealand, and this obviously includes the Board of Surveying and Spatial Information (BOSSI) in New South Wales.

The authors understand that at some time, CRSBANZ plans to disseminate the report among the surveying community. But the authors wish to make it clear that the contents of this particular paper does not necessarily reflect the content of the report to CRSBANZ, and CRSBANZ may or may not accept the authors' suggestions in that report. The issues in university surveying education which are raised here are not confidential, and are not relevant only to CRSBANZ.

2 DEFINING CURRENT DEGREE CONTENT

2.1 Why Define Surveying Degree Content?

Many surveyors will, of course, have an opinion about what should be in a university degree in surveying. Some high-level surveying material, such as aspects of geodesy or photogrammetry, or engineering design or Geographic Information Systems (GIS) can be contentious. The authors' choice of surveying degree content and also their approach to trying to make that selection might therefore be of interest, especially since the proposals have been passed on to CRSBANZ, who may at some stage base their assessment of degrees on the proposals. That list could be used to accept or reject degree programmes for entry into a profession, and may therefore influence students' entry into an employment avenue. The authors have therefore considered the matter carefully, as the account below should suggest.

It is necessary to begin by considering the fundamental question of what is being defined, and why. The universities themselves would have their own opinions as to what they fit into their degree programmes. It is apparent that statutory boards associated with CRSBANZ who have the responsibility to licence people to go into the community as 'registered surveyors', would need to ascertain whether degrees from universities in their domain meet registration requirements. Other groups associated with the surveying profession can also be interested in the content of a surveying degree. But perhaps the question only matters if there is such a thing as a surveyor. Does such a specific profession actually exist, and can a surveyor be exactly defined anyway?

The argument that there is not such a thing as a surveyor is based on the inverse notion: there is no definite educational content. Can graduates, nowadays, if they do not have the orthodox surveying education determine whether they would qualify as a surveyor? Consider a couple of interesting scenarios: Is it not possible to imagine a person who has a civil engineering degree, with extensive engineering design experience, and good TAFE qualifications in surveying and extensive work experience with GIS calling him/herself a surveyor? If that person applied for a position of surveyor, could someone not reasonably assess whether indeed that person is acceptable to do survey work – as a 'surveyor'. Can an organisation reject that person if it advertises for a surveyor, simply because the candidate lacks a familiar surveying degree? Indeed, if that person was rejected on that basis, might they not be able to seek the advice of their lawyer on that rejection? In the modern era, cannot a person 'cherry-pick' their own qualifications, but also cannot the person who employs or engages a surveyor decide whether that person's qualifications or experiences are suitable to them? If a person arrives from overseas with a surveying degree which, unlike most, does not include any photogrammetry, for example, can they not still regard themselves as a surveyor? So, to vary the question asked above: Is there really such a definable thing as a surveyor? And moreover, if it is difficult, does it matter whether the profession has or does not have a consistent view of what a surveyor is?

Although the answers to many of these questions are affirmative, it is also fairly obvious that certain groups – professional and industry organisations – do see certain people as surveyors. These organisations – and notably, in the case of CRSBANZ, those statutory bodies – may want to accredit or assess degrees. If so, then presumably there are times when the educational qualifications of those people need to be assessed to see whether they fit the model of what are regarded as surveyors, from a legal or community point of view. But, as well as that, it does seem that certain people, and only certain people, are regarded *by the profession and perhaps by other allied professions and even by the wider community* as surveyors (and by the Australian Tax Office when you put ‘surveyor’ as your occupation on your income tax form!). Other people who are not surveyors do not generally try to call themselves surveyors. If that is the case, it should be possible to isolate the common things that bring all surveyors under one umbrella, and excludes everybody else. What is it that makes certain people ‘surveyors’? Once that is defined, the requisite university course material may be more apparent.

If people are to be regarded as surveyors, then what is crucial is a *minimum* list of things they must *all* know about in order to be regarded as a surveyor, not a total list of all things that they might like to know about. This is not a simple concept, as it involves deciding that some topics should be left out of the minimum list, but of course they can still be included by the educational institutions. Topics which people see as desirable, like engineering design or GIS expertise or business practices or even a good general knowledge may be excluded from a minimum list. Even so, the minimum list can be developed by recognising that certain people, and only certain people, are regarded by the profession and by the wider community as ‘surveyors’ because they are capable of doing the wide range of things that *all* surveyors can do. And *only* surveyors can do all those things. There is knowledge which is the province of the surveyor. Furthermore, surveyors should be recognised and be proud of that knowledge.

Engineering design or GIS expertise or business practices or even a good general knowledge are valuable – but they can be excluded from the list because, in the end, there are other professionals who do those tasks, and they are not crucial to enable surveyors to do what only they can do. It is helpful if a surveyor is a GIS expert, but if this is not covered in a person’s qualifications, that person is still a surveyor. On the other hand, if that person cannot calibrate their Electronic Distance Measurement (EDM) instrument, that person is not a surveyor. It is the crucial or essential coverage that needs to be enumerated. It is therefore argued that a check list must contain *not* what is *desirable* for a degree, but what is *essential* for a surveyor’s education. After that minimum coverage, a university programme – or a person’s individual education – could cover more material, whether higher geodesy or useful land economics or the enlightening education – but the use of a minimum list must not exclude from the profession those who had what was crucial. The authors contend that that minimum content should fit the criterion that it would be included in a degree if, for some reason, it was decided to educate surveyors in minimum time or at minimum cost!

2.2 The Adopted Definition of a Surveyor

The most difficult part of the topic selection process is to define the surveyor which says what the community would expect all surveyors to be able to do. CRSBANZ (CRSBANZ, 2013) refers to the definition provided by the International Federation of Surveyors (FIG), which relates primarily to the ‘functions’ or ‘activities’ of the surveyor, which does not enumerate specific tasks.

But as well, the CRSBANZ website explains that “*land surveying is the definition of land boundaries by the application of survey procedures and exercise of judgement in accordance with precedent and statute law. It includes surveys for the layout of cities, sections, roads and streets; the disposition, subdivision, alienation, resumption, amendment of title and other dealings in land and interests in land. It also includes the collections of material facts and the giving of evidence for courts of law in cases of damage, title boundary disputes, the rectification of titles, etc., the preparation and giving of professional opinions, and interpretation of descriptions and other documents pertaining to land and interests therein...*” and “*...there are many other surveying disciplines*”, which are listed.

Definition was also assisted by the outline by the Institution of Surveyors New South Wales (ISNSW) as it was seen as perhaps suggesting how surveyors see themselves: “*Surveyors carry out measurements both above and below ground and water, surveying by varying means to establish relative position and size of both natural and man-made objects*” (ISNSW, 2014).

Despite all the things that a surveyor might do, it was seen that, even in the modern era, and even with changes in technology and the ways that surveyors can do their work, the distinctive attribute of a professional surveyor in Australasia is still that of a professional measurer. All surveyors are able to undertake precise spatial positioning in a way that no other professional can, knowing the precision of the positioning and also whether it suits the purposes of the survey. All surveyors know about measuring the general topographic surface of the earth, and natural and constructed or cultural features on it, such as roads and buildings, and can measure a range of other objects, which may be from a few metres to some kilometres in size, particularly industrial objects, buildings and various other engineering structures, while operating if necessary in a wide variety of situations, including underground, on industrial sites and on the water. They know about setting-out points to define the location of objects to be constructed, to as high a precision as is required (and to a level which is higher than non-surveyors might), and converting the measurement data to spatial information of high accuracy, calculating in three dimensions and/or taking into account the curvature of the earth if necessary, while knowing the accuracy of the information they are providing, and presenting the results of the measurement as spatial information in a form required by a second party, while surveying safely, and communicating surveying results professionally with colleagues, clients and the public. Non-surveyors cannot be expected to do all this.

2.3 Crucial Surveying Educational Content and the Essential Surveyor

This list of tasks can then be seen as creating a special group of mandatory course topics, which, in line with the thinking above, are the province of surveyors. These topics ‘belong’ only to surveyors and belong to all surveyors. A classic case in the past was precise positional astronomy. No GIS expert or civil engineer, or accountant or politician could do it. The reasonable person in the street assumed surveyors could do it, and expected that nobody else could do it. But what else now fits into that core category of the province of surveyors? The nominated list includes professional field measurement, especially with total station and Global Navigation Satellite System (GNSS) technology, processing the measurements to deduce spatial information, the presentation of that spatial information, control surveys, and surveys for engineering, industrial, mining, tunnelling and hydrographic purposes, but also cadastral surveying, and even geodetic surveying.

After that, there are matters that people other than surveyors know, but some knowledge *about* them is *needed* by surveyors to enable them to execute the essential tasks listed above.

This can even include engineering, GIS, Computer-Aided Design (CAD), but also sciences and mathematics. These proposals are shown (but not detailed) in Table 1. Beyond that there is the material which is desirable but *not* mandatory, such as additional GIS, engineering, mathematics, sciences, economics and perhaps some general education.

Table 1: An outline of categories of surveying degree topics in terms of the proposed mandatory topics and desirable topics.

| Category of Topics | Summary of Coverage |
|--|--|
| Mandatory matters seen as the province of the surveyor: | Field measurement, processing measurements to deduce spatial information, presentation of spatial information, control surveys, surveys for engineering, industrial, mining, tunnelling and hydrographic purposes, and cadastral surveying, geodetic surveying. |
| Mandatory knowledge, to support the crucial work of the surveyor: | GIS, CAD, sciences, mathematics and statistics, report writing, land development, water and geotechnical engineering, road and railway design, transportation management, town planning, property valuation, remote sensing, business management, work health and safety, ethical matters, social issues. |
| Material which is seen as useful and desirable, but which should not be mandatory: | Earth sciences: geophysics, geology; geography; computing skills, programming, economics, engineering design for land development (hydrological, hydraulic, geotechnical, transportation, structural); road and railway design, mining engineering, indigenous studies; positional astronomy theory and practice, higher geodetic surveying and geodetic science, higher photogrammetry. |

2.4 The Underlying Characteristics of Surveyors

The interesting part of that selection of key surveyor's work seems not to be to detail course content so much as a recognition that there are a number of crucial characteristics of surveyors, the special group of course topics which are the province of surveyors, only surveyors but all surveyors. Identifying these matters may help create a surveyor's sense of identity and even of worth. After all, it seems to be arguable that too many times the surveyor is seen as a secondary profession. The engineer calls in the surveyor when some marks are wanted, like a chef calling in the kitchen hand to clean up the dishes while the chef decides what to cook next. It is the engineer who 'builds' the buildings – just as it is the chef who makes the cakes – while the surveyor never gets any credit. There exists a comment by Lemmens, from Delft University of Technology, that at the end of a day making observations at a construction site, surveyors leave and "*...perhaps some nails have been hammered into the asphalt. How can a profession be promoted without impressive products and appealing icons?*" (Lemmens, 2012).

However, there seems to be some benefit in recognising the surveyor's niche, if only for our own satisfaction. Users of GNSS to position, say, infrastructure around cities are often encountered. They know the GNSS jargon and the Map Grid of Australia (MGA) jargon – but when it comes to the hard questions about precise GNSS positioning and map projections, only surveyors can answer them. Surveyors who do not face geodetic issues on a daily basis may find they are a bit vague about some things, but somewhere the answer can be provided – by a surveyor. This list goes on: a surveyor is needed when expertise is required in adjustment of observations or photogrammetric theory or precision GNSS. Moreover, surveyors typically know more cadastral law than most lawyers, and only surveyors can execute cadastral surveys.

Historically, surveyors certainly had a distinctive role connected with land development and mapping. During the era of the Europeans' exploration of Australia and New Zealand, many explorers were surveyors. In subsequent eras, surveyors continued to be involved in mapping,

and were out and about on the land well before most other professions. Arthur Streeton's painting 'Surveyor's Camp', depicting a site near Richmond, NSW, in 1896, reveals how the surveyor was mapping, in the field, on the land, before perhaps any other professional worker. This connection with the land continued of course with the surveyor's crucial role in rural and urban land developments and the construction of all manner of infrastructure. It is a struggle to think of a historical painting that characterises, say, accountants or lawyers.

3 OTHER ISSUES IN UNIVERSITY EDUCATION OF SURVEYORS

The surveying industry's concerns about education often relate to the low numbers of surveyors being graduated. Surveyors, quite reasonably, can have views on what can be done about it, just as they have thoughts on surveying degree content. However, misunderstandings about how the higher education sector works – especially now, as compared with how it worked in the past – may occur. Some education issues are reviewed in this section.

3.1 Tertiary Entry Scores

The relevance of programme entry score requirements – now the Tertiary Entry Ranking (TER) across all of Australia – is a little complicated and often misunderstood. The principal use of the TER by university administrators is to regulate student numbers in a programme. Thus, the more *popular* programmes have higher TERs to constrain student numbers, and *vice versa*. However, the wider community – including prospective students and their parents – can assume, reasonably but quite incorrectly, that entry scores are based on academic assessment of course difficulty. This perception means in turn, that a low entry score is seen by the public to equate to an easy course. An easy course may seem attractive, but in fact it seems that an easy course implies a low status course, and one which is likely to lead to a lower income. It actually seems that many students want to study for a degree with a high TER cut-off, whether because it gives the course higher prestige, or because they expect a higher income! A vicious cycle can be created: a high prestige course can have high demand, hence a high TER, which creates further demand. What is important here is that surveying can have the reverse problem: it has a low demand (probably because it is relatively unknown as a profession), so the TER drops and the prestige and demand appeal is reduced even further. Of course, universities also have the option of setting a programme's TER artificially high, even for programmes with low numbers, to raise their status and hence their appeal. But the first point to recognise here is that surveying can lose out to other courses with a higher TER, and therefore with higher prestige, if its TER is allowed to drop.

The second important point may be to recognise that the academics (including those in surveying) may have no influence on the cut-off score which is typically set by university administrators. The decisions are often made at a level above even Faculty heads. The surveying profession therefore may have no means of influencing the TERs that they would like to see for surveyors who eventually proceed to registration.

3.2 Financial Priorities

While the community can regard the universities as educational institutions which are concerned primarily with educational issues relating to students, it has to be recognised that over the past couple of decades, as funding levels have dropped and funding formulae have become more complicated, the first challenge of university administrators has probably

become to balance their budgets. The business model seems to have taken precedence over the educational model. In particular, universities can be more responsive to student demand for programmes than community demand for graduates from their programmes. Surveying is not necessarily safe from closure simply because there is an argument about a shortage of surveyors and its impact on the community. There is a shortage of surveyors because there are few students taking up the degree programme, and that makes the programmes expensive and in danger. But what is important, following from a similar point made in section 3.1, is that the surveying profession may have no means of influencing the maintenance of surveying degrees and hence influencing the number of surveyors.

3.3 Research and Programme Viability

The universities' attitude to research has often been misunderstood. As with the comments made in sections 3.1 and 3.2, it is seen that the community's belief and the universities' attitude may be completely different. The community probably once saw research as an optional side activity for staff who were so underworked that they would undertake interesting investigations, but that misunderstanding, like the assumption that universities close down outside teaching periods, is slowly dying. For universities, research is a very significant activity. They support research activity intensively, as a means of generating income through research grants, but perhaps just as importantly, research is seen to generate reputation and ranking which is used for publicity, to attract students (especially better students) and yield community esteem and hopefully benefactors. The homepages of university websites typically display research success, and perhaps even their world ranking, which is presumably influenced by research success.

Research activity is therefore generally expected of all academic staff. Staff appointments are normally influenced heavily by a candidate's research success, often measured by publications (not necessarily in journals read by practising members of the profession) and by their ability to secure research grants. For surveying, the viability of some undergraduate surveying programmes may be as much influenced by research profiles as by actual undergraduate numbers. The point is that it can be foolish to regard research as a distraction from surveying educational needs, but it would be beneficial to recognise that a lack of research in surveying can actually hamper programme viability. Admittedly, surveying research may not always be seen to benefit daily survey practice, but the surveying profession should not view academic research in matters which they do not immediately make use of as wasteful. It may be more helpful if the profession can do what it can to encourage research in certain specified directions which are useful to the profession.

3.4 Student Satisfaction

Despite the assertions made above that teaching concerns can take second priority to financial management and research success, it is possible to detect an increasing importance being attached by funding agencies, and hence in turn the universities themselves who want some of the funding, to student satisfaction. This is most obvious through a growing number of irritating and unwanted student questionnaires.

The Tertiary Education Quality and Standards Agency (TEQSA) website confirms this move, advising that *“TEQSA will undertake both compliance assessments and quality assessments. Compliance assessments involve auditing a particular provider's compliance against the threshold standards for registration as a higher education provider. Quality assessments can*

either be an assessment of the quality of an individual provider or a review of an issue across a number of providers (a thematic review)” (TEQSA, 2013).

The implication is that teaching may be regaining some priority, and this may balance the dominance of research and strictly budgetary priorities. But the danger may be that the student satisfaction surveys may pay more attention to education technique and student contentment – even student pampering – rather than to ensuring that students learn! In that regard, the profession can note that at least it can retain some influence on programmes through universities’ programme advisory committees and also in procedures for professional accreditation.

3.5 The Revolution in Electronic Media

It is hardly surprising that in the current era there is pressure for an escalation of the availability of electronic materials for students. Students’ expectation of electronic teaching material now includes routine provision of audio/visual presentations, such as PowerPoint presentations and YouTube video clips. But there is also university pressure and student expectation to provide online course materials such as video copies of lectures and copies of associated material. But it can be a concern that the modern student generation is so familiar with electronic media that it has a reasonable expectation of accessing online educational material instead of live attendance. With plenty of online material, attendance at university is seen to be a less important part of their daily routine, allowing students to change their daily timetable. It is noticeable that students spend less time on campus than in the past, their lives revolving more often around part-time work and their own social networks. It is occasionally reported in the media that for the current student generation, owning a car may not be as much a priority as an electronic social media device, and presumably also a computer. The availability of online material helps save extensive amounts of travel time and even the common hassles of car parking. But unfortunately, remoteness from university and from staff contact may detract from the learning experience, which is especially important in the case of practically oriented surveying.

Online capabilities allow not only students but the universities themselves to look at education in a new light. Remote learning can help resource saving in teaching and in the not-insignificant capital cost of lecture theatres, and other infrastructure, even the car parking mentioned earlier. Online learning is appealing to universities for large-scale teaching – even if teaching staff are concerned that it is less effective. Charles Darwin University claims to be the first Australian university to offer Bachelor and Masters level programmes in chemical engineering online (CDU, 2013). Universities are looking to engage in online education, sometimes as large-scale educational schemes with other cooperative institutions, as a means of both growth and survival. This new education (or perhaps business) model has been outlined by Professor Caroline McMillen, Vice-Chancellor of the University of Newcastle, who last year promoted the concept of offering course material online in the Newcastle Herald (McMillen, 2012). What was most interesting was the fact that the material would be offered free, but a student must enrol – and then pay a fee – if they want assessment. McMillen observed that such an online course in Circuits and Electronics, offered by Massachusetts Institute of Technology and Harvard together, attracted 155,000 enrolments – but with 7,000 students passing the course. It remains to be seen what impact these sorts of changes will have on surveying programmes and their practicability in coming years.

4 CONCLUDING REMARKS

The authors have taken seriously their proposal for enumerating crucial surveying degree content to CRSBANZ, and accordingly an outline is given here for the logic and the processes used to enumerate such a list. However, listing crucial material can provide a revelation that the surveyor has certain characteristics of which surveyors should be proud. Other issues in the changing education scene deserve to be recognised to ensure that the surveying profession keeps sight of how it can best face possible continuing low student numbers.

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