



Attracting new students to study surveying

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ABSTRACT

CONTEXT

Surveying has an image problem. The report, “Determining the Future Demand, Supply and Skills Gap for Surveying and Geospatial Professionals” prepared by BIS Oxford Economics for the industry group Consulting Surveyors National, found that surveying and spatial scientists will be in a capability deficit position at the national level for the next five years to FY2023. The report found that workforce gaps could be in part addressed through the hire of new university surveying graduates. Nine universities in Australia and New Zealand provide suitable qualifications to support the surveying industry. Attempts to attract new students still do not satisfy industry demand.

PURPOSE OR GOAL

Surveying is a niche profession closely allied with engineering and construction. There has been a skills shortage in surveying for more than two decades. The education sector has partnered with industry and government to actively encourage more students to study surveying. A range of activities targeting high school students and beyond have been attempted. A selection of activities, successes/fails is presented, and some new endeavours proposed which build on experience.

APPROACH OR METHODOLOGY/METHODS

Messaging focuses on four key items: indoor/outdoor professional career; maths (geometry)/geography; maps; technology/gadgets. Students who like any of these aspects will likely enjoy a career in surveying. The design of activities to attract new students is informed by a combination of student/participant feedback and experience. The enrolment/graduate numbers at various institutions will be investigated. The qualitative observations and feedback from participants/presenters are used to justify changes in approaches to activities designed to attract new students.

ACTUAL OR ANTICIPATED OUTCOMES

Despite high demand for well-paying jobs in the surveying industry, many university programs have struggled to maintain sustainable programs. External marketing efforts supported by industry have helped to maintain numbers. A time series of enrolment and graduate numbers at various institutions will help inform the efficacy of these marketing efforts.

CONCLUSIONS/RECOMMENDATIONS/SUMMARY

Surveying is sometimes seen in the wider community as an obsolete profession or even a trade. Marketing efforts seek to communicate the high-tech nature of modern surveying, its professionalism and its widening application and value to allied industries. A range of activities and their evolution (based on feedback) are presented. Student enrolment/graduate numbers are presented to support the argument that surveying programs remain viable. Efforts to attract more students to take up surveying studies must continue and evolve to meet industry demand.

KEYWORDS

Surveying; Skills Gap; Education

Introduction

Surveying enjoys a rich history. The foundation of modern Australia was established by early surveyors/explorers. Surveyors Captain James Cook, Burke and Wills and Sir Thomas Mitchell evoke a rustic colonial history as do surveyors from the Snowy Hydro scheme and the Sydney Opera House. This colourful past, whilst nostalgic, taints a public perception of a surveyor from a bygone era, inhibiting marketing efforts to attract new students to a modern surveying career.

Marketing surveying has many advantages. It is very easy to secure an attractive, high paying job. It is an indoor/outdoor professional career. Surveyors work at all levels of government, could run their own surveying practice or work for large engineering consultancies or even in science/ research. Indeed, geodesy – the science of the shape and gravity field of the Earth (a key part of surveying education) - provides a fundamental reference (sea level rise etc) for authors of the IPCC Climate Change reports.

Surveying has “purpose” which is a persuasive marketing asset for students. The World Bank emphasises the importance of a secure system and land titling and ownership to underpin a national economy (World Bank, 2014). Land titling refers to the cadastre¹ which is created and maintained by Registered Land Surveyors (RLS). 30 – 40% of graduates from UNSW go on to become RLS and surveying is experiencing a skills shortage. Consequently, industry support tends to focus on graduates with a desire to become registered. Students must first complete a 4 yr accredited surveying degree at one of the 9 accredited² programs in Australia and New Zealand.

Marketing efforts

Surveying has experienced a skills shortage for more than two decades (BIS, 2021, Roberts, 2011). In that time many and varied activities have been attempted to attract new participants to the profession.

Marketing efforts at university

In 2016 UNSW made a **program change** to offer a 5yr dual award (Surveying/Civil Engineering) degree to compliment the existing 4 yr Bachelor of Engineering (Surveying) degree. This has proven popular as evidenced by increased enrolments (Figure 2). Students can graduate as a fully qualified Surveyor and Civil Engineer in 5 yrs.

University Open Days are scheduled a month before high school students are required to submit their preferences for future university programs. Open days are centrally organised, large-scale events and surveying programs have always provided hands on activities to engage attendees.

The Faculty of Engineering at UNSW has developed relationships with high schools to host ‘**high school information days**’ twice per year since the 1990s. 200 – 300 students visit campus and nominate three schools for 1 hr activities, bookended by faculty information presentations. Several other similar activities such as the Engineers Australia Indigenous Engineering summer/ winter school, Aspire (Aspire, 2022) and the Honeywell summer school (EA, 2022) all present similar opportunities to raise the profile of surveying to potential students using hands-on, on-campus activities.

Within the School of Civil and Environmental Engineering (CVEN), the Industry Advisory Committee (IAC) recognised that it was difficult to offer engineering work experience to yr 10/11 high school students due to WHS constraints on large sites. To overcome this problem CVEN offers a so-called ‘**bus tour**’ to eligible students. A dedicated coordinator in the school is tasked

¹ The Cadastre is a methodically arranged public inventory of parcel-based information and data concerning all legal land and real property objects within a jurisdiction. It shows the nature, size, value and legal rights, restrictions and responsibilities associated with each land and real property object (ICSM 2020).

² The Council of Reciprocating Surveyors Boards (CRSBANZ) is the accrediting authority (BOSSI 2022).

with reaching out to up to 90 schools and attract one student each to attend a full week of activities scheduled in the school term break. Three buses with 30 students per group undertake 5 x full day activities ranging from a geotechnical visit to the Sea Cliff bridge, a visit to Sydney Water or a Surveying technical visit to Circular Quay and the Opera house for example. A range of hands-on activities are undertaken, and the students return to UNSW campus to write a short report on their experiences every day. This is designed to mimic the reporting of a site visit for a professional engineer/ surveyor. It is also marketing. Surveying is branded as just another engineering discipline as part of the 'bus tour' week.

HSC Maths Ext 1 and Physics are pre-requisite subjects for future students enrolling in all engineering programs at UNSW. The pool of students who undertake these higher-level subjects has been diminishing in recent years (King, 2021, NESAs, 2022). To address this issue, CVEN sponsor a '**Maths primary school prize**'. Academics visit the school presentation day and encourage yr 6 students progressing to high school to keep enjoying maths/ science courses. No mention is made of careers at this stage. This activity is an attempt to grow the pool of future maths/science students. It is also marketing to parents as they realise who is sponsoring the prize.

Marketing efforts by professional bodies

The surveying professional and industry bodies recognised the growing skills shortage two decades prior. One of their first responses was to devote administrative staff hours to coordinating visits to **high school careers markets** across NSW. A box filled with posters and flyers is couriered from one event to the next and local surveyors volunteer to attend and encourage students to consider a career in surveying by studying at university or TAFE. Surveyors receive some training on how to engage students and receive CPD points for their efforts.

As a one-off, profile-raising event, the industry bodies proposed a campaign style activity in Martin Place, Sydney with a large video screen showcasing modern surveying, tents with displays and surveyors handing out flyers to pedestrians over their lunch hour. It was an expensive failure as surveyors felt uncomfortable engaging pedestrians who were often busy and disinterested. Martin Place located in the CBD and is a banking and commercial hub, not the demographic interested in a career in surveying for themselves or their children. This was an expensive learning experience.

These industry bodies have since evolved into the **Surveying Task Force (STF)**. Initially commencing in Victoria, it is funded by a coalition of private and public sector industry bodies concerned about the lack of surveying graduates from TAFE and universities. A professional marketing company was engaged and developed a strategy called '**A Life Without Limits**' (ALWL, 2022). The taskforce consulted widely and developed modern branding and messaging. It was immediately successful in Victoria as evidenced by increased student enrolments and subsequently attracted funding for a similar taskforce in NSW and SA.

The taskforce seeks to raise the profile of surveying as a career for high school leavers and career changers and initially tried to support existing activities. **Work experience for year 10** students has been identified as an important driver for future students. The taskforce has sought to match survey firms with local high schools to encourage more work experience engagement. Survey firms are encouraged to plan for the arrival of a student and ensure they offer 'good' work experience and a range of tasks. It is an important marketing tool. Issues such as white cards and WHS practices must be carefully managed (Roberts, 2022).

The '**Maths in Surveying Day**' committee was formed by a local surveyor and a group of retired Maths teachers who were also members of the Maths Association of NSW Inc (Roberts & Iredale, 2010). They have hosted a ¾ day event at least 2 times per year since 2008. It is held at Bicentennial Park, Homebush, Sydney and the program rotates through 2 x 3 hands on surveying activities separated by lunch in the middle. Volunteer students and surveyors assist on the day and CVEN at UNSW always supplies equipment and staff. Student numbers range from 60 – 100 and feedback is collected at the end of each day. The surveying taskforce assists with the coordination of this activity.

More recently, the taskforce has identified the lack of women in surveying and have sought to address this by developing the '**Diversity in Surveying**' days held on (or near) International Women's Day. Whilst diversity is the target, it is the diversity of job opportunities that is on show at this 'high-end' high school event. Three hours of hands-on activities (Figure 1) are on offer in the morning for the ~60 attendees followed by a sit down 3-course lunch. The tables are sponsored by surveying companies who bring a mix of directors and young staff to engage with these high school students. A range of speakers share stories of their professional careers and students are encouraged to sign up for work experience and other opportunities on the spot. Vox-pops and photos are captured. The NSW Governor and Surveyor General of NSW have attended this event.

The NSW Education Department is looking to develop a new subject into their **iSTEM** suite catering to the yr 9/10 curriculum (NSW Dept Education, 2022). A sub-committee of the STF have been developing a 25hr module in 'Surveying and Geospatial Engineering' that can be offered for one term. It is hoped that the course design will be embraced by NSW teachers. Much emphasis has been placed on indoor/outdoor classes for teachers to run, leading to the design of a larger project local to the school. This program will commence as a pilot in T3, 2022.

Branching from the iSTEM work, maths teachers within the NSW Education department are developing new learning activities targeted at **Stage 4 and 5 mathematics** entitled 'Maths in Surveying' to empower teachers to support students to become mini-surveyors (iSTEM 2022).

Marketing collateral

Marketing activities are supported by collateral in the form of paper brochures, websites, vox-pops, professional photos and video explainers. Much of this can be found on the Life Without Limits website (ALWL, 2022, Surveying Careers, 2022), but all universities also produce their own detailed brochures. It is important that the language and the offerings are consistent to avoid confusion and promote the same message to future students and career changers.

Methodology

The opportunity to showcase surveying to high school students should not be wasted. Whilst some introductory remarks are required, students should be quickly engaged in hands-on activities with clear outcomes and reflection. Lectures to students should be avoided. Current university students are encouraged to assist at events and talk with high school students of their experiences.

To address the 'image problem' of surveying in the wider community, activities should indeed recognise the rich history that surveying enjoys but then design activities to showcase the range of new technology that modern surveyors now use: UAVs, GNSS (satellite positioning), laser scanners, robotic total stations, 3D visualisation software etc.

A common theme through all the marketing efforts presented above is the focus on hands-on and often outdoor activities. The marketing messaging focuses on four key items: indoor/outdoor professional career; maths (geometry)/ geography; maps; technology/gadgets. All of this informs the design of these hands-on activities, but some subtle nuance has evolved with experience.

When designing activities for high school students it is important to understand the age group and the level of maths/ science capability. Topics such as trigonometry can be exercised and enriched by taking real observations with surveying instruments and making real world calculations to answer problems. Connecting what is learnt at school with real world applications is powerful.

Activities should be designed to enable success for the students which means sufficient time must be built into the activities. For example, novice students take a long time to look through the telescope of a surveying instrument, let alone focus a crosshair and make a measurement that can be used for a trigonometric calculation. Activities should seek to build confidence in the students without excess time pressure, provide a clear outcome and instructors should try to review what was done so students can reflect on their learning.

An example of this is the 'height of tower' exercise at the 'Maths in Surveying' day; an exercise designed to be completed in 50 mins. Several student groups are shown a distant tower and asked

to estimate its height. They are given a work sheet which takes them through the trigonometric steps to compute the height. A surveying total station is setup and students are guided to use this device to measure the vertical angle and distance to a target. Supervisors (and trainee teachers) assist with the calculations. All groups compare their estimate with their calculation and compare with the other groups. Differences in these solutions give instructors an opportunity to discuss some more complex issues such as errors and uncertainty in measurements in the real world.

This last point is very important. These marketing efforts are looking to attract students to study for up to 2 years at TAFE or 4 years at university to become a qualified technician or surveyor. If students complete an activity in 50 minutes with a simple answer, they may question why they need to undertake tertiary qualifications. It is important to elaborate on the problems/uncertainties encountered to demonstrate the complexity but also engender curiosity and ongoing interest in the discipline. Can the student picture themselves studying surveying for their career?

Student/ staff feedback informing activities

Student and teacher feedback comes in various forms. The Maths in Surveying days have requested students to provide quantitative (scale of 1-5) and qualitative feedback since its inception in 2008. It is very difficult to learn much from quantitative feedback other than one exercise might be overall more popular than another. This is borne out in comments where there is usually an even split between likes and dislikes for almost all activities. Common words like 'interactive', 'fun', 'being active', 'astronomy', 'cool tech' were repeatedly used as positive comments. 'I used maths to find the answer', 'applied my trig', 'like computers' were also indicative.

Teachers also noted that their students were more engaged and curious. Some maths teachers commented that it was the first time they had done an excursion for maths.

Presenters and surveyors should be aware of students becoming bored or disengaged. Very hot/cold weather can sap motivation and after 6 exercises, students will tire and be difficult to motivate.

All of these experiences reinforce the need to only provide engaging, fun but challenging activities and also for skilled presenters to observe student attention and adjust their activity accordingly.

The exercises at the Maths in Surveying Day have changed over time as have the presenters and the weather conditions for each event. It is therefore almost impossible to measure any numerical improvement in the engagement of students due to informed adaptations to activities.

Activity example: Defining legal land boundaries

As stated above, the taskforce is focussed on students wishing to pursue a career in land surveying. Land surveying is often described as a 'mysterious art' and is therefore difficult to explain to the public (Roberts, 2018). At marketing events, registered land surveyors (RLS) often bring old survey plans and encourage students to find old survey marks, but usually students are not sure why they are doing this and are therefore disengaged.

At the 2022 Diversity in Surveying event, a new 45-minute activity was designed to overcome this barrier. Some fundamental rules of cadastral surveying were presented to students as the 'rules of a game'. The rules are simplified from the regulations under which RLS are required to follow for legal boundary definition in NSW. Students were shown an imaginary parcel of land on a plan and asked to mark it out on the ground. The cohort was split into 4 sub-groups who each determined and marked one boundary corner based on information from the plan. The entire group reconvened to measure the sides of the whole parcel. Instructors used a white board in the field and were able to discuss discrepancies between the plan and what was marked on the ground (Figure 1). This 'game' was designed to take ~30 minutes and allowed novice students to start to appreciate the challenges faced by land surveyors and the professionalism inherent in the career. After this, students were handed some real survey plans, were quizzed on some information on these plans to encourage detailed inspection of the plans and then asked to find old survey marks. This subtle new approach enabled students to think about how a land surveyor might use this plan to determine the legal boundaries. Feedback was far more positive than from past activities.



Figure 1: Legal boundaries exercise; Bridge monitoring; Showcasing high tech laser scanners

Activity example: Bridge monitoring

Another engaging activity involves 20-30 students collectively monitoring the sinking of a bridge. A small accessible footbridge on UNSW campus has been identified. Two digital levels on either entrance to the bridge are setup with line-of-sight to a stable benchmark external from the bridge and a staff mounted on the midpoint of the bridge structure. The student group is split in two on either side of the bridge, whereby the first student of each group observes the staff on the benchmark and the staff mounted on the bridge with the digital level. A second student records the observation (Figure 1). The first student then walks to the centre of the bridge (thereby loading it), the second student repeats the observations and a third student books etc. This sequence is repeated until all students have taken observations. As the bridge is loaded with progressively more students, the level staff apparently sinks thereby recording the deformation of the bridge. The whole sequence can then be unwound as the students reverse the sequence yielding more observations as the bridge is unloaded. The data is then graphed by the students and comparisons between each group can be made. Instructors reflect on the activity and students are very engaged in the outcome of their observations. They also learn about the movement of structures and how surveying can monitor this movement.

Student numbers across Australia and New Zealand

There are nine universities in Australia and New Zealand that provide accredited surveying qualifications that lead to Registration/Licensing for surveyors: Curtin University (CU), University of South Australia (UniSA), RMIT University (RMIT), University of Melbourne (UMelb), University of Tasmania (UTAS), University of New South Wales (UNSW), University of Newcastle (UNewc), University of Southern Queensland (USQ) and University of Otago (Otago). All are 4yr degrees except UMelb which offers a 3+2 program since 2008.

All nine universities were contacted to provide information about the number of enrolled students in their respective programs and the number of graduates over the last 10 years (Figure 2). The number of enrolments reflects more on the success of marketing activities. These numbers should be seen as indicative. It is very difficult to capture accurate information as students may have discontinued and not informed administrators or be enrolled in part programs. RMIT, CU and UNewc did not provide data.

USQ and Otago dominate the numbers of enrolled students (Figure 2). Otago is the only surveying degree offered in New Zealand and enjoys a high demand for new students and a consistently high number of graduates, many of whom come to Australia to work. This is due to the consistent marketing efforts from the University of Otago in partnership with the wider New Zealand profession from the 1990s onwards (Hannah, 2006).

USQ has offered both face-to-face and distance education since the 1980s. Distance education is a very convenient strategy, especially for mature age students who may already be working. Structural changes to their offerings over the past decade which enable students to progress from a 2yr Diploma to a 3yr and ultimately 4yr accredited degree are clearly attractive to students as is reflected in the trend of the enrolments since 2012.

The remaining 4 programs exhibit smaller but relatively steady enrolments. A spike in 2016 for UNSW reflects the launch of a new double degree (Surveying/Civil Engineering), which has enjoyed continued success and a general upward trend in enrolment numbers.

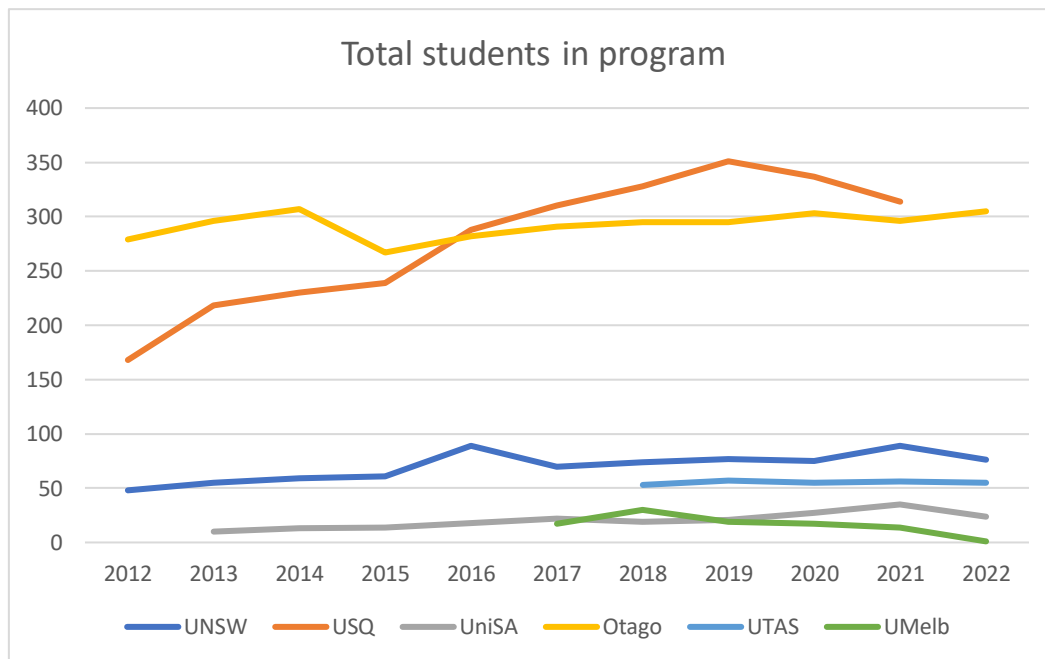


Figure 2 – Number of students enrolled in surveying programs across Australia/New Zealand

The number of graduates provides more reliable numbers compared to enrolments (Figure 3).

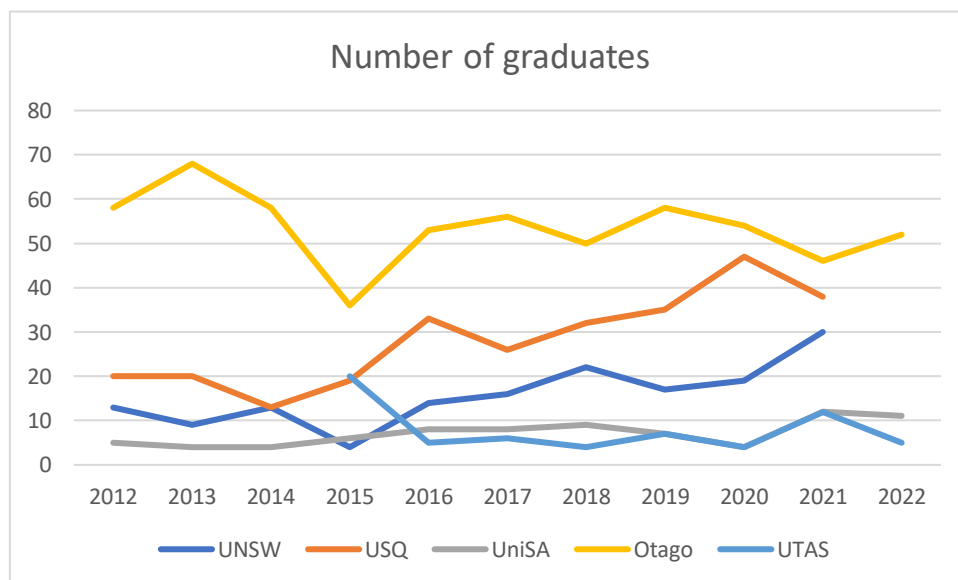


Figure 3 – Number of graduates in surveying programs across Australia/New Zealand

Again it is clear that both Otago and USQ dominate the number of graduates. The larger number for UNSW in 2021 can be explained by the high number of new entrants in 2016 completing their programs. UniSA also changed from a 3+2 program in 2015 back to a 4yr program however their numbers have remained steady. UMelb did not supply number of graduates.

Strategies for attracting new students

Figures 2 and 3 do not indicate definitively the impact of a particular strategy to attract new students. Structural changes to programs implemented by USQ and UNSW appear to have promoted increased enrolments which convert to more graduates. However, UNSW have also been actively engaging more with the NSW STF and a range of other internal and external marketing activities as detailed above in the *marketing efforts* section. Both structural changes to programs and better and more frequent marketing are important.

Surveying is a small profession with limited resources. Marketing activities should try to target the broadest range of potential students rather than ad hoc activities for one school. The UNSW “bus tour” attempts to do this by reaching out to 90 separate schools but only allowing one student per school to attend. If the student has a good experience, it is hoped they will tell their teachers and friends thereby spreading the word. Word-of-mouth is a powerful marketing tool because recipients of the message trust the information and are more likely to be persuaded (UNSW, 2004).

The Bachelor of Engineering (Surveying) degree at UNSW has the highest ATAR of any surveying degree in Australia. Additionally, UNSW require Maths Ext 1 and Physics as prerequisites for first year courses. Careers advisors and teachers must be made aware of program specific requirements and encouraged to select suitable students to engage in marketing activities leading to a surveying education.

Consistent messaging is important across the profession. The NSW STF can assist the wider profession to ensure they use the same language, websites and collateral to ensure that potential students are not confused by mixed messaging.

Engagement with industry at marketing events, on-going work experience and the promise of a certain job upon completion of their studies are very persuasive for new students.

Concluding Remarks

The BIS Oxford Economics report identified the need to increase new university surveying graduates to address the skills shortage in surveying (BIS 2021). Surveying has a good story to tell, with lots of high-paying, interesting jobs, an indoor/outdoor professional career, high-tech devices and software and an interesting variety of travel and applications.

However, for the last two decades there remains a skills shortage. Challenges include:

- small, overworked industry with limited resources to promote themselves,
- a diminishing pool of students studying higher maths and physics eligible to take up university studies in surveying (King, 2021),
- outdated community perceptions of the modern surveying industry,
- lack of diversity across the current surveying industry,
- the challenge of hiring new university staff due to the disconnect between the practice of surveying (important for teaching surveying graduates) vs university demands for research outside survey practice (Roberts & Harvey, 2019).

Marketing efforts in recent years provide more consistent messaging. Activities are becoming more targeted to students likely to take up future studies in surveying. Students need to see complexity and purpose in an imagined future career as a surveyor.

Program changes at UNSW to offer a 5 yr dual award degree to compliment the 4 yr surveying degree and sustained efforts in marketing over the last 5 – 10 years in partnership with industry have seen a gradual increase in surveying enrolments at UNSW.

Coordination from the Surveying Taskforce (NSW and nationally) is crucial to promote the benefits and opportunities offered in the surveying profession and to address the ongoing skills shortage.

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