Recruitment and Retention of Students in the Geospatial Sciences

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Abstract- **For the last few years, Geospatial Science at RMIT has pursued a more aggressive approach to the recruitment of students and also focussed more strongly on the retention of students. This has involved much more than direct marketing and extends into a process that considers recruitment as a continuum from initial contact through to successful transition into the university system. The skills shortage in the geospatial sciences will be with us for some time and there is no quick fix. The market place is crowded with options and Gen-Y hassignificant differences to previous generations, which we are attempting to address with our marketing strategy.**

***Keywords* – intrusion detection, statistical model, agents, Markov Models**

INTRODUCTION

Over the last few years, an interesting and possibly disturbing dichotomy has emerged in the geospatial sciences in Australia. While there has been an unprecedented growth in the demand for labour in the discipline, at the same time, we have seen low demand from students seeking places in university programs in geospatial science. For example, in Victoria, approximately 33000 year 12 students each year choose to enter a university program. Of these, only 0.2% enter a geospatial science program and often this is not their first preference.

This disturbing trend was highlighted in 2006 at a meeting of university Heads of Departments that offer geospatial science programs [10.]. Since then, a number of important initiatives have emerged. For instance, the Spatial Education Advisory Committee [15.] has analysed the market place for employment in the spatial sciences and produced a workforce plan for the industry. While exact numbers are difficult to quantify, the SEAC Workforce Plan suggests there is a projected shortage of about 700 qualified staff Australia wide across the industry by 2013 [15.].

It is clear from this study that the geospatial science profession faces a significant undersupply of qualified staff for many years to come.

The recent downturn in economic activity may alleviate some of the pressure but this is likely to be a temporary respite.Added to this is the ageing profile of the profession, particularly in the field of surveying, with many practitioners reaching the twilight of their professional careers and looking to scale back or retire. The Surveying industry in Victoria became so concerned about this issue that they formed the Surveying Industry Taskforce, with the specific mission of promoting the career opportunities in Surveying. The Taskforce is a collaborative exercise between all sectors of the surveying industry and involves the Surveyors Registration Board of Victoria, the Consulting Surveyors Victoria, the Institution of Surveyors (Vic), Spatial Sciences Institute, the general surveying industry, RMIT University and the University of Melbourne. The Taskforce engaged professional marketing analysts and consultants to develop a'brand' for Surveying, together with a formal marketing plan and new promotional materials. It is too early for the impact of this new marketing initiative to be assessed but there is anecdotal evidence that it has raised awareness of the opportunities available.

McDougall et al. [10.] also highlighted changes occurring within the Higher Education Sector, with more focus on 'user pays', administrative changes to streamline operations and save costs, and amalgamations of small departments into larger units. These changes create an environment where small, niche programs, such as those typical in the spatial sciences, struggle to survive. Further changes are coming as the Federal Government begins to implement recommendations from the Review of Australian Higher Education [1.], which will make it even more important to attract students into geospatial science higher education programs, as funding will governed by demand for places.

II. OTHER FACTORS AFFECTING STUDENT DEMAND

For a number of years, other factors have been at play in the selection process in Victoria. These have had a significant impact on the number of potential students commencing geospatial science programs. Some of these factors are:

- In recent years, many secondary schools have not offered Geography as an option in years 11 and 12. There has been a decline of about 300 students (approximately 11%) studying Geography Units 3-4 in Victoria in the last ten years (Hincks, 2008). Although geography is not a pre-requisite, it has traditionally been a feeder subject, with many students who enjoyed studying geography searching for a program of study that incorporated aspects of geography.
- The percentage of students undertaking higher level mathematics in Victoria has significantly decreased over the years, with a 14% fall in VCE enrolments in higher level mathematics in the five years up to 2007 [8.]. As Maths Methods is a prerequisite for Geomatics and Surveying, this has reduced the pool of students available to these programs. It is of significance that over the last few years, at least three or four students per year have enquired about undertaking a maths bridging course, as they realised too late that they had not studied the required maths pre-requisite for the programs.

The issues are complex and are a combination of demographic and societal trends, combined with the low public profile of our industry and the difficulties in successful marketing and promotion of careers in the geospatial sciences. Awareness of the problems and the marketing issues faced by providers of geospatial sciences programs can be problematic even within their universities.

A recent expert review of the School of Mathematical and Geospatial Sciences [14.] congratulated the school on its continuing contribution to RMIT University and noted that:

> *The school is small, but of great strategic importance to RMIT in providing its specialist expertise in both teaching and learning and research.*

The panel also noted:

> *as critical to the development of the school that the university make a strategic investment in marketing at the program level, with the aim of increasing demand among students with the potential to succeed.*

(14.,p. 2)

Although the panel explicitly raised the importance of marketing at a program level, current university marketing strategy is focused on the promotion of the RMIT brand. It is very difficult in this environment to find support for the creation and distribution of program specific materials that we believe are a necessity when marketing these niche programs.

Working within this complex environment, numerous strategies and promotional materials have been developed. Experience in producing these materials, and particularly in gauging their effectiveness, confirms that an understanding of today's learners and their characteristics is essential when communicating with these students. This is the case whether it is in promotional activities, teaching and learning or when constructing orientation and transition programs. Effective marketing and communication with potential students is critical so that students have realistic expectations both before they arrive at university and throughout the all important first year [7.].

III. Generation Y – Characteristics

Many students currently entering university belong to Generation Y, also termed the Millennial Generation, the Net Generation and Digital Natives amongst numerous other labels. This generation (those born approximately between the years 1980 and 1994) are generally considered to be highly technologically literate.

Raines [13.] describes the characteristics of this group as: sociable, optimistic, talented, well-educated, collaborative, open-minded, influential and achievement oriented. Howe and Strauss [4.] also point out that the Net Generation: gravitate toward group activity, believe "it's cool to be smart", is focused on grades and performance, is busy with extracurricular activities, identifies with parents' values, is respectful of social conventions and institutions, has a fascination for new technologies and is racially and ethnically diverse.

McCrindle and Beard's [9.] studies of consumers and the factors that influence their decision making summarise these key points about Generation Y:

- They are socially connected and their decisions are likely to be influenced by their friends.
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- They like things to be fun and entertaining, yet they are hard to engage.
- They like cool and socially desirable things, but not "try-hards".
- They want life-enhancing experiences.
- They want new and innovative things, yet are unable to articulate exactly what will meet their needs.

It is also suggested that Generation Y, when compared to previous generations, exhibits different characteristics in terms of requirements and expectations of their learning environment. Oblinger&Oblinger[12.] observe that today's learners are: digital, connected, experiential, immediate and social and that their learning preferences tend to be: teams or peer-to-peer, by engagement and experience, visual and kinesthetic.

An understanding of Generation Y's characteristics, influences and learning preferences is not only important in terms of marketing, but also with respect to their orientation and transition activities and teaching and learning. At the same time it is necessary to be aware that although the generation starting university now is likely to be more representative of these characteristics [16.], making general assumptions about them, particularly with respect to their digital background, risks overlooking the diversity within this group of students [5.].

IV.RMIT Geospatial Science student cohort

Although the vast majority of students entering our programs are from Generation Y, the student group entering Geospatial Science programs each year is by no means homogeneous, and this cohort varies in composition from year to year.

TABLE 1

RMIT Geospatial Science Student Cohort (2007)

2007	Total	Male	Female	Year 12	Others
Geomatics	18	16	2	12	6
Surveying	21	21		9	12
Cartography	11	9	2	8	3
Geomatics/Computer Science	1	1		1	
Total	51	47	4	30	21

TABLE 2

RMIT Geospatial Science Student Cohort (2008)

2008	Total	Male	Female	Year 12	Others
Geomatics	16	11	5	13	3
Surveying	32	31	1	15	17
Cartography	16	13	3	10	6
Total	64	55	9	38	26

TABLE 3

RMIT Geospatial Science Student Cohort (2009)

2009	Total	Male	Female	Year 12	Others
Geomatics	23	21	2	16	7
Surveying	32	30	2	15	17
Cartography	12	9	3	6	6
Total	67	60	7	37	30

Total numbers of commencing students from 2007 to 2009 have increased each year and the percentage of females varies significantly from year to year and within programs, however, it is low (8% in 2007, 14% in 2008 and 10% in 2009). The percentage of students not coming straight from high school (Others) is high - 41% in 2007, 41% in 2008 and 45% in 2009. Of note is that out of all students currently enrolled in all undergraduate programs across all years, only 17 are not of Generation Y. Enrolments in 2007 were at an all time low, aswere numbers of female students. Whether this was a result of a lack of marketing and promotion has not been established, however it seems obvious that it was at least a contributing factor. Geospatial Science started a concerted marketing strategy in 2007. While there was a significant increase in student numbers from 2007 to 2008, it cannot be established that there is a direct link between this and the increased numbers.

V. CASE STUDY IN MARKETING OF GEOSPATIAL SCIENCE AT RMIT

Since 2007, Geospatial Science has employed various strategies and undertaken numerous activities in order to raise awareness of our programs to potential students. Many of these strategies have been developed in response to results from the first year student questionnaire from which data has been gathered for over five years. These results indicate that students who have already selected our programs have done so for numerous reasons. The top three influences in past years have been: secondary school careers teachers or other teacher,relatives and friends and members of the profession. Other significant influences, which at least 3 people listed in their top three influences include: the RMIT website, attendance at RMIT Open Day, visiting a career's expo, someone from Geospatial Science visiting their school, their ENTER score and the VTAC guide. The clear message emerging from the data is that people have found out about their selected program in different ways and that from a marketing point of view it is strategic to build on these influences as much as possible. The following paragraphs outline current strategies and activities.

VI. SECONDARY SCHOOL CAREERS TEACHERS

For the last two years, Geospatial Science has had the opportunity to present program information to secondary school careers teachers early in the year, at an RMIT careersteacher's event. Significant positive feedback was received from these sessions. For the past three years, final year cartography students have produced a calendar of maps in their atlas mapping class. The calendar includes promotional information, including graduate profiles and has been

distributed to all Victorian secondary school careers teachers, as well as many local, national and international organisations in the Geospatial Science field.

VII. National Youth Science Forum (NYSF)/Siemens Summer School

Each year for the past three years, Geospatial Science has participated in the NYSF and the Siemens Summer School in which top secondary school science students from across Australia take part in numerous activities in various discipline areas in order to broaden their understanding and expose them to possible areas of study. This is another avenue for disseminating program information and as friends and relatives are consistently listed as influencing potential students it is seen as another way of promoting understanding of our programs in the broader community.

VIII. Promotional materials

Three years ago, Geospatial Science produced information brochures for each of our programs. These include detailed information about the programs, frequently asked questions and graduate profiles. These brochures were sent to all secondary school careers teachers and are handed out by Geospatial Science staff and students when undertaking school visits. Anecdotal evidence suggests that a number of students have been greatly influenced by receiving this information at their school and have chosen our programs as a consequence.

IX. RMIT website

A growing number of students each year choose to obtain information about the programs from the RMIT website. For this reason it is imperative to update the information on a regular basis and to provide examples of student projects and career profiles as well as all standard program information.

XII. School visits and careers expos

For the last two years, final year students undertaking the final year course Professional Practice have been given the option of visiting their old high school to promote our programs. The vast majority of students have chosen to do so. A number of commencing students have indicated that a school visit by someone from Geospatial Science was a big influence in their decision making. Numerous schools also request guest speakers throughout the year and a number of academics undertake these activities. For the last few years, Geospatial Science has also had the opportunity to present an information session at numerous large scale careers expos, such as the Age Careers Expo.

X. RMIT Open Day

During Open day students have the opportunity to see many displays and examples of student work, but most importantly, they get to talk to both staff and current students. Although less than half commencing students attend Open Day, those who do say that it has played a large role in their decision making. Feedback suggests that the opportunity to talk to staff and students is the most important factor.

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XII. Generation Y – How do we hang on to them?

Major studies in both Australia and overseas [17.,11.] have identified numerous factors that cause transition challenges. These include: academic difficulty, inability to adjust to the academic and social life of the university, unclear goals, lack of commitment, lack of finances and feeling isolated or marginal in university life. These factors affect all new students to some degree, be they school leavers, mature age, rural or international students. It is widely acknowledged [2.] that problems in this period of transition equate to high attrition rates, which is problematic from both a student and institutional perspective.

In response to these well-documented transition challenges and the high rates of attrition in the first year, there has been unprecedented growth in first year transition programs across Australian universities in the past decade [2.]. There appears to be general agreement that not only do universities need to develop comprehensive transition policies [6.], but that schoolsand departments need to design and implement specific transition strategies to assist their students [2.]. Tinto [18.] stresses that the more academically and socially involved individuals are, the more likely they are to persist.

RMIT University has followed the trend and a number of university wide transition initiatives exist across all RMIT campuses, including numerous activities throughout orientation week before classes start. Other transition programs are run at a College level. The School of Mathematical and Geospatial Sciences sits within the College of Science, Engineering and Technology (SET) which started the SET Transition and Support Network in 2004, in order to improve student transition. At the SET College level, peer mentoring programs are the most common transition activity, with many schools implementing some form of student mentoring program.

XIII. Geospatial Science half-day orientation program

Geospatial Science runs a half-day orientation program in the week preceding the start of semester 1 each year. Each attending student is provided a Geospatial Science handbook (updated each year) that includes a range of information about the programs they are studying, the facilities, the staff, study skills and information technology together with other useful orientation and transition information.

The orientation program consists of a brief welcome and introduction by the Head of Discipline, a 'what's it all about' session, an introduction to student services at RMIT, and a brief introduction to the first year academic staff. The entire introductory session lasts one hour. Experience has shown that students can be overwhelmed with information and that they also do not perceive the need for a large volume of information at this stage.

After the introduction, students participate in a getting-to-know-you session. The aim of this session is to enable students to introduce themselves to each other and to make them aware that they have many similar characteristics. In order to achieve this, they are asked to group themselves in numerous ways: by number of siblings, by their program of study, by their pet type, by their work experience and by their location of residence, to name a few. Each time a new group is formed, they are asked to introduce themselves to all members of the group who they do not already know. This session is followed by a campus tour and then a barbecue with staff and postgraduate students from Geospatial Science.

XIV. Transition embedded in academic programs

All commencing students undertake the course Scientific Communication, part of which is run in a one-week intensive mode in the first week of semester. This course encompasses many transition elements. It enables students to establish basic competencies in the use of software and hardware, provides them with an introduction to professionals in the geospatial area, engages them in collaborative group fieldwork and introduces them to the wider campus. Sessions are run by academics from Geospatial Science (both first year and from later years) and post graduate Geospatial Science students. Activities include a field project at the Geospatial Science Field Station at Yarra Bend.

At the conclusion of the first week's transition activities, students are asked to evaluate how they feel. Nearly all 57 students who responded to the questionnaire in 2009 indicated that they agreed that they felt more comfortable commencing studies at university and that they were happy that they had chosen the right program of study. Although a few did not agree with this statement, it is our belief that the earlier they can make a decision about whether they are enrolled in the right program of study, the better for all concerned.

XV. Applied Geospatial Techniques

As an enhancement of these transition activities, funding was received for an Action Research in Teaching and Learning (ARTL) project with the aims of enhancing the first year student's transition to university life, fostering a better understanding of the interrelationships between the different strands of Geospatial Science and allowing students to gain experience in the use of geospatial technologies in a holistic way. This project resulted in the development and evaluation of a new course – Applied Geospatial Techniques (AGT), which was taught in the 2nd semester of 2006 for the first time. The course was conceived and is taught by a team of lecturers and is run as a series of practical workshops with students working in small, mixed-program groups. The results of this research were very positive, indicating that students benefit from and enjoy practical, 'real-world' problem-based projects and that they did indeed feel more a part of the Geospatial Science community at RMIT by the end of the course.

Discussion

We have been engaged for some years in a concerted, multi-pronged marketing strategy. This is primarily aimed at students in Year 10 at high school, as this the point at which they make subject choices that influence the programs they can enter at university. While this can be reinforced in the later years of high school, it is important to catch their interest at this critical point. As we are two years into a cycle that is likely to take three years to deliver results, it is too early to evaluate how successful these measures have been.

From anecdotal evidence, we know we struggle to find penetration in a market place that is crowded with options. However, by adopting a multi-pronged approach, we increase the opportunity for interaction with the Gen-Y group. Our current students visit high schools to engage the social connectedness of this group, the activities and demonstrations we offer seek to entertain as well as inform, we are conscious of not "overselling" our programs and try to offer realistic and grounded advice, and we use graduate profiles to highlight the opportunities and experiences that our graduates enjoy.

It is encouraging to see other sections of industry responding to the skills shortage and taking ownership of the recruitment problem. In some cases, they have invested significant time and money into the promotion of careers in the spatial sciences, specifically targeted at Gen-Y.

The SEAC Workforce Plan also identified the retention of staff in the industry as an important issue. We see this starting at university level and our transition programs are aimed at providing students realistic experiences of the spatial sciences as early as possible. This means that some students drop out of programs very quickly but we see this as preferable to students continuing without being fully engaged and then leaving disenchanted with the career.
We believe there are many opportunities to engage with this group and make them aware of the careers available in the geospatial sciences, but we are under no illusions about this

being an easy task. Gen-Y in turn has much to offer as both students and employees and we should rise to the challenge of engaging with them and benefiting from their strengths and abilities.

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Gita Pupedis, Kriss Bellmans.Studentu ieinteresēšana un piesaiste ģeotelpiskajām zinātnēm
Pirms kāda laika Austrālijā bija liela atzinība idejai pievilināt vairāk studentus ģeotelpiskajās zinātnēs. Tika organizētas vairākas vietēja un valsts mēroga aktivitātes lai šo ideju īstenotu ieinteresējot skolu absolventus un brieduma gadu potencionālos studentus. Valdošais nākamo studentu „tirgus" ir Y paaudze; studijas būtiski ietekmē demogrāfiskā situācija. Pēdējos gados Melburnas Tehnoloģiskajā institūta (RMIT) ģeotelpiskās zinātnes orientētas uz aktīvu nākamo studentu piesaisti, kā arī uz stingrāku politiku attiecībā pret esošo studentu saglabāšanu. Tas tiek īstenots vairāk nekā tiešs mārketings un paplašinās attiecībā uz jauno studentu uzņemšanas procedūru kā augstskolas sistēmā sekmīgu integrēšanu. Rakstā izteikts viedoklis par studentu uzņemšanu un viņu sastāva saglabāšanu ģeotelpisko zinātņu augstākajā izglītībā. Raksturota pieredze strādājot ar pirmā studiju gada studentiem RMIT, raksturota arī viņiem domātā mācību literatūra. Kopš 2006. gada pirmā kursa studentiem ieviests jauns priekšmets: Lietišķās ģeotelpiskās tehnoloģijas, kas ietver lekcijas un praktiskās nodarbības ar studentiem mazās grupās.

Гита Пупедис, Крисс Беллман.Заинтересованность и привязка студентов к геопространственным наукам
До определенного времени в Австралии была большая поддержка идее об увеличении числа студентов в геопространственных науках. Организован ряд мероприятий местного и государственного масштаба с целью реализации данной идеи, заинтересовав выпускников школ и потенциальных студентов зрелого возраста. Основной «рынок прызыва» будущих студентов это поколение Y, но на высшую школу влияет и демографическая ситуация. В последние годы государственная наука в Мельбурнском технологическом институте (RMIT) ориентирована на активное привлечение будущих студентов, а также на более строгую политику в отношении сохранения существующего студенчества. Это осуществляется более активно по сравнению с методами прямого маркетинга, увеличиваются активитеты по приему студентов как составной части системы высшей школы. В статье высказано мнение о приеме новых и сохранении существующих студентов в геопространственных науках. Охарактеризован опыт, основанный на обследованиях студентов геопространственных наук первого курса RMIT, состояние учебной литературы для них.Начиная с 2006 года, студентам первого курса проводятся занятия по новому предмету – Прикладные геопространственные технологии. Читаются лекции, а практические занятия проводятся в малых группах.