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Recruitment, retention and progression of Geomatics undergraduates at Newcastle University



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1. Introduction

Over the last 20 years, the geomatics community has endured great anxiety and debate surrounding the recruitment of young people to university courses and the profession. While debate in the international arena has ranged around the subject's name (e.g. Onsrud and Pinto (1993); Trinder and Fraser (1994); and Ballantyne (1996)), a need for community wide responses to the problem (Parker and Booth, 1999) and even the problems posed by secondary education phenomena (e.g. Lemmens, 2001), the issue of having to recruit young people has remained. The last ten years have seen drastic changes in geomatics university education in the United Kingdom. The decreasing numbers of students studying geomatics and the increased financial pressure on universities have led to the closure of several geomatics degree courses across the country. As a result Newcastle University is now the sole provider of Royal Institution of Chartered Surveyors accredited undergraduate geomatics higher education in the UK. The undergraduate programmes in geomatics are also accredited by the Institution of Civil Engineering Surveyors.

Based within Newcastle University's School of Civil Engineering and Geosciences (CEG), the geomatics group conducts a broad range of teaching, research and commercial activities. Geomatics undergraduate degree programmes, under one name or another, have been offered at Newcastle for more than 50 years and now have an annual intake quota of 35 UK and EU students, plus several "overseas" students each year. Even in the face of research, third-strand and service teaching pressures, securing an annual intake of 35 students is the biggest challenge the geomatics group at Newcastle University faces. To try and meet the challenge, the group has undertaken a wide variety of recruitment and engagement activity coordinated by the wider university, and has also undertaken a significant amount of geomatics-specific engagement and

recruitment work. The group's work includes an internationally recognised geomatics public engagement project and, more recently, a new programme working with school teachers that is showing promise.

The variety of experiences and practices over the last 10 years have allowed the group to articulate a student life cycle that now underpins the marketing and recruitment work of the group. This paper sets out that life cycle and describes some of the marketing and recruitment work undertaken by Newcastle University's geomatics group.

2. The Undergraduate Student's Life Cycle

In 2006, the School of Civil Engineering and Geosciences adopted a "life cycle" approach to the recruitment, retention and progression of its students. These terms are defined as follows:

Recruitment: The process by which applications to the degrees are encouraged and the subsequent conversion process, i.e. persuading an applicant to eventually register for a degree.

Retention: The process by which students who register for the degree programmes are retained for each year of the programme through a combination of academic success and personal enjoyment/comfort in the surrounds.

Progression: The successful movement of a student after graduation. This may be to employment, postgraduate study or some other activity that is the ambition of the graduate (e.g. travelling).

The life cycle adopted is based on a student that is resident in England and who will leave school at 18 years old to join university. It can be presented as a flow diagram (Figure 1). Clearly, there are exceptions to this set of conditions but it does conform to the majority of Newcastle's geomatics students. The ability to articulate the life cycle

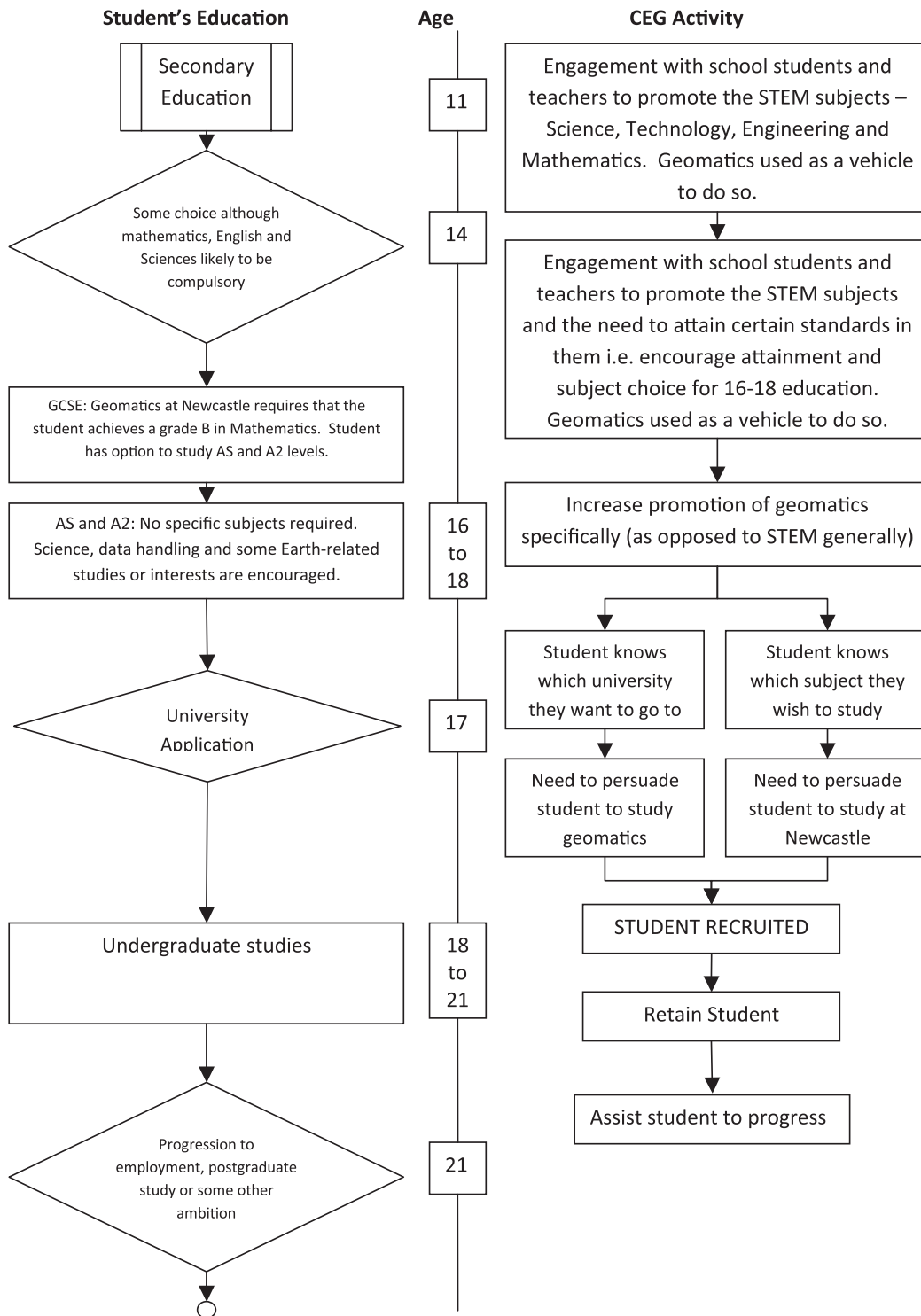


Fig. 1: The Undergraduate Lifecycle.

came after several years of continued recruitment and promotional work. What were originally treated as separate components of recruitment, retention and progression became increasingly intertwined as virtuous links and positive feedback loops from different activities were identified.

3. Recruiting students

3.1 Recruitment at Newcastle University

Within the university, there is a variety of stakeholders in the lifecycle process to support the recruitment of undergraduate students. The contributions range from general, university-wide concern though to a geomatics-specific focus. Table 1 summarises the roles of the different groups in the university with regards to the recruitment of students.

As one would expect, there are a variety of activities undertaken throughout the structure outlined above that have an intended or a virtuous benefit to the geomatics group. These range from university-wide promotion events such as University Visit Days or Higher Education Conventions (where potential students can collect information from most, if not all UK universities from a single event) through to very focussed activities such as science taster courses or geomatics-specific promotional material. The life cycle model the group has adopted shows that university and STEM promotion all has a role to play in student recruitment and, as such, the group now accepts all invitations to contribute to any schools-focussed outreach or engagement activity irrespective of its direct relevance to geomatics.

Increasing concern and focus on the health of undergraduate geomatics programmes	Marketing and Communications Directorate (MCD)	<p>With an overall responsibility to develop and promote the business and brand of the university, the MCD splits into four sections:</p> <ul style="list-style-type: none"> ■ International Office – specific remit to meet the needs of international students joining the university. ■ Recruitment and Admissions – focuses on pre-application activities, including widening participation, and the administration of applications. ■ Marketing and Publicity – design and delivery of promotional materials for a variety of media ■ Press and Communications – media relations, corporate and internal communications
	Faculty of Science, Agriculture and Engineering (SAGe)	<p>A team of four people exists to:</p> <ul style="list-style-type: none"> ■ Act as a conduit between the MCD and the schools. ■ Realise science and/or engineering specific taster events to raise interest in those areas particularly. ■ Provide support mechanisms for schools delivering secondary education-focussed materials. Examples are the creation and maintenance of www.teacherstoolkit.org.uk and the organisation of Teachers Groups that allows practicing teachers to meet with university academic and outreach staff.
	School of Civil Engineering and Geosciences (CEG)	<p>A broad range of academic activities with the following undergraduate focus:</p> <ul style="list-style-type: none"> ■ Delivery of 6½ full time undergraduate degree programmes in Civil Engineering, Civil & Structural Engineering and Geomatics ■ Fill an intake quota of approximately 130 students through the generation of applications and subsequent selection and conversion of applicants to registering students.
	Geomatics group	<ul style="list-style-type: none"> ■ Deliver two full-time undergraduate degree programmes ■ Fill an intake quota of approximately 35 students through the generation of applications and subsequent selection and conversion of applicants to registering students.

Table 1: Stakeholders in the recruitment stage of the undergraduate life cycle.

3.2 Geomatics.org.uk

As student numbers entering geomatics dipped in the mid 1990s, the geomatics group felt it necessary to take action of its own. Relying on university and STEM-wide activity was not proving to be sufficient in terms of recruiting students and a need for a geomatics-specific message was required to be available throughout a student's secondary education. By 2000, the first of two significant recruitment-related initiatives was in the planning.

The difficult recruitment situation was not unique to Newcastle and so, after identification of a variety of professional and practising stakeholders and contacts in other universities, in 2002, Newcastle became the leader of a UK Geomatics community-wide effort to engage secondary school teachers and students in a programme known as *Geomatics.org.uk* (Mills *et al.*, 2004). The project was not a Newcastle recruitment project, rather a geomatics-community wide engagement initiative that hoped to support all members' recruitment ambitions through increased awareness of the subject area. The project ran successfully for four years, being mainly funded by the Engineering and Physical Sciences Research Council, but also enjoying support from trade and professional bodies, other universities and enthusiastic individuals. The project name was taken from the website that was central to the project. *Geomatics.org.uk* aimed to provide an online portal to the UK Geomatics community that would be accessible to schools particularly; and to offer free loans of professional Geomatics equipment to support practical work in schools.

CEG still runs the scheme of equipment loans although without funding support from the Geomatics community. Since 2002 CEG, either individually or as part of the *geomatics.org.uk* project, has given out more than 150 equipment loans to schools, thereby increasing the awareness of Geomatics nationwide. The majority of equipment loans have supported Geography field studies, particularly in the domains of river and coastal studies, but in latter years, mathematics and science teachers saw the potential of geomatics to show real-world application of their disciplines and often in a practical and outdoor environment.

3.3 Geomatics-based Continuing Professional Development (CPD) for teachers

With the end of *geomatics.org.uk* in 2006, the geomatics group began to look for a new project to promote geomatics to secondary (11-19 years old) teachers and/or students. The new project took shape in late 2007 when the geomatics group won funding from the UK Government's Training and Development Agency for schools to design, deliver and evaluate geomatics-based Continuing Professional Development courses for secondary teachers. The courses aimed to introduce teachers of different subject areas, e.g. Maths, Physics and Geography, to geomatics and show how it can be used to support secondary teaching and learning.

A total of 24 people attended the courses, including teachers of varying experience, educational consultants and graduate students training to be teachers by completing a Postgraduate Certificate in Secondary Education. At this stage, the sample sizes for impact evaluation are small and, therefore, not too much weight can be lent to them. However, the early indicators suggest that using geomatics as a tool to run CPD for teachers has great potential. Feedback collected on the day of each course gave the following results:

- the courses were rated as Excellent (17 responses) and Good (7) on a four point scale of Poor, Fair, Good or Excellent
- asked about the relevance to their job, 14 felt the courses were excellent, 9 Good and 1 Fair
- 11 people felt that the relevance of the course to future career aspirations was excellent
- 23 felt that participation and "enjoyability" of the courses was excellent
- 20 would definitely recommend these courses to colleagues and friends and 4 would probably do so.

Comments from on-the-day feedback included:

"Enjoyed day – buzzing with ideas to begin to plan"

"I found the course materials, practical experience + the delivery excellent. Very relevant in terms of new Key Stage 3 programmes of study and also the new A -level courses. The offer of follow up sessions in schools + the useful contacts is also an excellent resource. Excellent on a personal + professional level to review + extend knowledge + skills and then disseminate to department + to pupils."

“The course has given me some excellent ideas to feedback to my organisation.”

“Well run session with aims clearly outlined and relevance to subject constantly highlighted. I think it is an excellent way of raising students’ interest in physics and giving them an insight into real life applications.”

As part of the evaluation, delegates were contacted three months after the event and asked to complete an online survey that examined what they could remember from the course and identify any impact it had had on their teaching. The online survey results, although from a smaller pool of people than the on-the-day feedback, offered further insight in to the impact the project may have had.

Only 25% of those responding to the online survey had experience or knowledge of geomatics prior to the course. Since the event, 75% of those responding had used geomatics in their lessons. The level and form of this use ranged from a single lesson through to a week of activities taking in about 10 lessons in all, including some practical-based lessons. One course delegate responding to the survey, a Head of Geography in a high school, stated that the school has invested in some GIS software as a direct result of the course. For the course to stimulate this purchase at a time when GIS attracts a growing profile in geography curricular is a considerable positive impact. This teacher is now involved in the geomatics group’s interest in realising a teacher-focussed GIS CPD course (see below, Future Work). For those that had used geomatics with their students since the course, this had taken place in all secondary year groups except at ages 15-16 when the pressure of the national General Certificate in Secondary Education limits the time available to staff and students to complete enrichment work.

All of those responding to the survey felt that geomatics-based teaching and learning is appropriate for academic and vocational learning and a large majority felt that it could be used to support learners of all abilities. Asked for commentary, the following were offered:

- Maths: It made pupils think about that area of maths in a completely different way and made them apply thinking skills.
- Geography: It developed the way students make linkages between data and the spatial location/diversity of that data – also provided interest and challenges for students who

otherwise would be disinterested by traditional paper based fieldwork and follow up.

- Maths: Pupils are not often given the chance to learn by experimenting and using equipment in an outdoor setting. So pupils are given the chance to learn in a different way.
- Maths: It helped them with learning Trigonometry

Interviews with four participants from the courses afforded considerable qualitative feedback relating to the impact the courses might have had. Highlights from two of those interviews are presented below:

1) White British Male, teaches year students aged 11 – 18, has 1-5 years teaching experience and falls into the age group 25-34:

What attracted you to use Geomatics in your teaching?

It struck me as very, very different, something that none of the kids will have come across before. None of them will have had their hands on this stuff before. They like being outside, they like doing things that are different that was one thing. I wanted also to give them the idea that Maths is not just about sitting in a classroom solving puzzles. It has real world uses as well and this is something they are familiar with ...”

Will you use Geomatics in your lessons in the future?

Yes definitely, it’s such a positive thing I will definitely get it again. Motivation and getting the pupils stuck into maths that isn’t just run of the mill stuff it’s something different and something practical. There’s loads of stuff I haven’t done yet.

2) White British female, teaches year aged 11 – 18, has 1-5 years teaching experience and falls into the age group 35-44:

What attracted you to use Geomatics in your teaching?

I just want to bring through to the classroom that maths is used truly outside. We can sit in the classroom and teach them, you know, how to do Trigonometry, how to use Pythagoras, angles and bearings which, for them, is far too often from a textbook or the board. This actually gives them some meaning, some understanding that things are really going on around them and I want to try to encourage them to actually stand and look to try to work out what is really going on

Owing to the success of the courses, they are being re-offered this year. Further delivery and, therefore, impact evaluation of the courses will make for a stronger report to be presented at a later date.

4. Retaining Students

It is not just the recruitment cycle that is at the core of the Newcastle Geomatics marketing strategy. Once recruited, a considerable level of support exists for the students during their time at Newcastle University and in the geomatics group in particular. With the challenge of recruiting a student being so great, it is essential that the group retains those who register. A variety of practices have been implemented or resurrected to try and ensure that the students have a stimulating and caring environment in which to work.

4.1 Induction

At the start of the first year, students are taken away on a residential induction course. The 24-hour programme involves travel to a Youth Hostel, a variety of outdoor team exercises supervised by the academic and research staff from the geomatics group, an evening quiz, overnight stay, team orienteering exercise and travel back to Newcastle. Feedback from 2008 graduates suggested that they thought this catalyst to the degree programmes should be repeated at the start of each academic year, such was its worth.

A geomatics industrial evening, run under the name of "Life during and beyond Geomatics" is also held at the start of each year which sees all students and staff join together with geomatics companies, professional bodies and trade groups for an evening of food, drink and introductions. Hosted in an on-campus restaurant, the event is designed to build bridges between the students and the wider geomatics community at the outset of their studies and then each subsequent year of study.

4.2 Teaching

At the start of the 2008-2009 academic year, CEG adopted a policy of issuing all first year undergraduate students with a student response device which can be used to interact with presentations given by teaching staff. There were two aims of adopting this system. Primarily, the system can be used to collect anonymous student opinion, feedback and be used to test knowledge and understanding. The formative

feedback and stimulating benefits of student response systems in a science environment are well documented by Reay *et al.* (2005). The second aim comes from the assigning of an identifiable "clicker" to an individual and subsequently monitoring attendance. Bowen *et al.* (2005) describe some of the motivation and benefits of adopting such a system. In the case of Newcastle, the aim was not to monitor hour-by-hour attendance but rather to identify students whose absence over several days may suggest their becoming distracted from, or disengaged with, the subject and see if the group can assist in any way.

Furthermore, there have been some significant changes recently in pedagogical practice in the geomatics group. From a survey of registering students taken at the start of each of the last four academic years, the geomatics group is aware that practical and field work is the joint highest attracting factor to the geomatics degree programmes. The first year field course remains a key part of the student's experience. As well as the technical experience of the course, living and working alongside staff realises a strong bond between staff and students. Fieldcourses are being re-introduced to the final year of the degree programmes from 2009. The final year fieldcourse was removed from the curriculum in the early 2000s owing to staff and financial costs being too high for a then small cohort of students, but their value in attracting and satisfying students is now so high that they are returning to the curriculum. E-learning tools are also being adopted to support teaching and learning (Mills and Barber, 2008).

As part of the student's final year studies of *Aspects of Applied Geomatics*, a three-day study tour is also now undertaken. Staff and students travel to see geomatics applied to a large scale civil engineering project (the 2012 Olympics site), a trade exhibition, geomatics commercial practices, the Ordnance Survey (Great Britain's national mapping agency) and the Leica Geosystems UK headquarters. Initially run in the 2007-2008 academic year, the event proved to be popular with the student body and was well supported by the geomatics community.

Significant resource has been assigned to the geomatics laboratory to give the students a functional yet pleasant space in which to focus on their studies. The laboratory is equipped with 10 common user PCs that are also equipped with the specialist geomatics-software required at various points through the degree programme. An

interactive whiteboard is in place to support IT-based group working and a survey pillar and wall mounted targets have been installed to support instrument practice and demonstration. There is space to meet with peers or staff, and room for equipment set up for interactive demonstration. The availability of such working environment has been greatly accepted and appreciated by the students and led to a closer interaction between the students. There is a separate school-wide wifi enabled common room that ensures the geomatics laboratory remains a place of study and not socialising.

4.3 Pastoral care and communications

The induction and teaching activities are complemented by pastoral and communications-based support. Formal structures exist to afford feedback and dialogue between the student and staff groups, including a personal tutor, staff-student committee, board of studies, an entry survey to determine why students chose to study geomatics at Newcastle and also confidential focus groups where, shortly before graduating, students can comment freely about their holistic experience with the group.

The geomatics group also introduced a student buddy system at the beginning of the last academic year. The scheme was set-up as parent-children system, where one Stage 2 student has been randomly allocated four or five Stage 1 students to their care. For Stage 1 students, the scheme aims to assist them with transition to higher education, particularly in areas such as time management, study skills and an empathetic ear all in the sanctuary of one's peers. The scheme offers the Stage 2 students opportunity to consolidate their knowledge through sharing with others and develop personal and transferable skills that will augment their technical education. Three formal sessions are scheduled between the parent and children so as to support its implementation, but the intention is that scheme operates in an informal and *ad hoc* nature between students.

It is planned to carry out a formal evaluation of the scheme later in this academic year by using questionnaires. Initial, anecdotal assessment of the scheme suggests that the scheme is working well and is of particular benefit to overseas students.

5. Progression

To make the life cycle approach complete, it is essential that affording a graduating student exciting opportunities is as important as their recruitment and retention. In fact, the employment prospects from a geomatics degree are, along with practical work, the joint highest attracting factor amongst the Newcastle geomatics cohort. To support the student progression into the professional world, CEG has adopted different events and support schemes for the geomatics students. Foremost amongst them is the introductory industrial evenings described above. Additionally, CEG has developed close working relationships with a wide range of companies, often through alumni and, therefore, further extending the "life cycle" approach. Industrial engagement has helped to support our students in finding a job after graduation, leading to a 100% progression level of the graduate students in 2007. Such a successful graduation: job conversion rate is a helpful statistic to convince potential new students to study Geomatics, supporting the marketing of the degrees further.

The group encourages and tries to assist students in finding geomatics-related work placements during their summer vacation periods. Companies wishing to recruit students are invited to give lunchtime presentations to the students. These visits combine with the running of an on-line jobs board, the study tour and guest lectures to support students in their search for work. Excellent students are encouraged to apply for summer studentships between Stages 2 and 3 with a view to their being recruited to PhD opportunities.

6. Future Work

It is an ambition of the geomatics group to continue to improve in the area of recruiting students. Attracting more mathematically minded and able students is one of the group's primary aims. A new project started in January 2009 that sees a maths teacher working with the geomatics group to identify new opportunities that may exist for geomatics to support teaching and learning in 16-19 maths education in the UK.

The group has a strong track-record in Continuing Professional Development (CPD) provision for geomatics practitioners, particularly in the field of GIS. With the rise of GIS' presence in UK school curricular, the group has started to explore delivering GIS CPD for school teachers.

7. Summary

Geomatics higher education around the world remains in a perilous position owing to low student numbers. There have been some signs of improvement, for example the opening of new courses, but student influx remains low (Lemmens, 2007).

The situation in the UK is no different. In response to the problem, the Geomatics group at Newcastle University has adopted a holistic marketing approach to try to guarantee the annual intake of 35 students. The approach, one of working against a student lifecycle, along with some specific practices adopted by the group, have been presented. The presented actions have demonstrated success, as evidenced by the 2008 intake of 41 “home” students plus two “overseas” students.

Despite the recent recruitment success of the group, it is vital to continue to actively recruit, retain and support the progression of students. With regards to recruitment, the first aim must be that of at least stabilising student numbers at the current level and ideally growing the size of the cohort. Furthermore, one could argue for a need to raise the standard of incoming students by seeking greater experience and performance in their secondary education of mathematics and physical sciences in particular. On the retention side, the group hopes that recently adopted practices and will further increase student satisfaction levels but student and industrial feedback will be used to seek continued improvement. The global recession may pose challenges to support the progression of students. In response, the group is already increasing its direct work with students on progression.

It is hoped that this paper offers points of interest and debate for others in geomatics and geomatics higher education.

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