# KNOWING OUR CUSTOMERS: A STRATEGIC ANALYSIS OF GEOMATICS STUDENTS

**Lilian, S.C. PUN-CHENG & Kent, W.K. LAM**

Department of Land Surveying and Geoinformatics
The Hong Kong Polytechnic University
Hungom, Kowloon
Hong Kong

Phone: (852) 27665968 Fax: (852) 23302994
Email: lspun@polyu.edu.hk, lskent@polyu.edu.hk

## Abstract

In the past decades, there have been considerable changes to the Hong Kong education system, some of which directly influence the management of tertiary education. At the same time, the Department of Land Surveying and Geoinformatics of the Hong Kong Polytechnic University has also gone through stages of restructuring. These changes were necessary, on one hand to adjust to the global broadening of the profession of Land Surveying to Geomatics, and on the other hand to respond to the changing philosophy in university education. In order to promote effective Geomatics education, a project is being conducted to analyze if these changes are beneficial to our graduates and employers in industry based on the survey results perfomed on our graduates. First, patterns of changes in the Hong Kong secondary school education system, in the geomatics courses of the University, and in career requirements of the geomatics profession are identified. Second, a complete student profile, including details of entrance qualifications, attainments upon graduation, on-going careers and/or continuing post-graduate education are analysed. The overall aims are to identify the preferred qualities of candidates to be admitted to our Department, the preferred qualities of our graduates, and whether our curriculum has successfully transformed preferred candidates to preferred graduates.

## 1. Background

Geomatics is a broad term that covers the disciplines of land surveying, mapping, geographic information systems, geodesy, photogrammetry, and remote sensing. The Department of Land Surveying and Geo-Informatics (LSGI) of the Hong Kong Polytechnic University is unique in offering such discipline from sub-degree, degree, to post-graduate levels in Hong Kong.

To promote and improve the management of these courses, it is worth reviewing past experiences both qualitatively and quantitatively, so that more concrete recommendations to better planning can be made. This paper presents some of the results in a study which identifies the qualities of preferred graduates to meet the challenge of increasing

opportunities in the geomatics profession within and outside Hong Kong. On the other hand, by identifying the recent primary and secondary educational reforms and their impact on tertiary education, with the LSGI department as an example, some insights into more rational educational management may be provided. In brief, it is worth noting that any future developments of university education should consider not only its internal factors, but also the overall educational and social system in the society.

### 1.1 Reforms in Secondary School Curriculum

In the past decades, there have been considerable changes to the Hong Kong education system, some of which directly influence the management of tertiary education. First, before 1992, there was a rather clear distinction between Higher Level (HL) students and Advanced Level (AL) students, sitting for examinations required by the Chinese University of Hong Kong and the University of Hong Kong respectively. The Polytechnics and Post-Secondary Institutions at that time did not have a rigid requirement of which specific examination candidates should take and in most cases depended on individual course requirements. In 1992, the last HL examination was held and then abolished. Instead, all sixth form students should sit for the AL examination in which students could choose to answer in English or Chinese for non-language subjects. Since 1994, the Advanced Supplementary-level (ASL) examination, with a more simplified curriculum than comparable AL subject, was introduced to the sixth form students. This aims at providing students a wider range of subjects to choose based on their capabilities. As a result, apart from the two compulsory language subjects of ASL - Use of English and Chinese Language/French, students could have a choice of taking three other subjects among the AL and/or ASL curriculum (Table 1). According to the Education Department (1999), the aim of this new sixth form curriculum is to produce balanced, well-informed individuals who are proficient in both English and Chinese, and who are prepared for further education, work and adult life.

Such curriculum reforms in the 90s have several implications. First, in terms of language, there was a clear distinction of English or Chinese for HL and just English for AL non-Chinese subjects, followed by a choice of either of the two languages in the present AL system. The recent promotion and implementation of native language teaching in junior secondary schools create a new factor of concern. Correlation between language training and the ability to succeed in university and career would be of interest not just to our Department but also to society as a whole. Second, in the past, science and arts students took very different subjects during matriculation, and some university courses had very strict requirements of either science or arts backgrounds. However, with the introduction of Advanced Supplementary (AS) Level in the 90s, some science and computing subjects may be taken by arts students and vice versa. Such broadening of academic backgrounds may affect the selection of new students, the design of university curriculum, and raises the basic question of whether the strict division of science and arts subjects is still desirable. Third, the introduction of information technology in secondary education as encouraged by the Government recently is assumed to positively influence the performance of our students, as geomatics is regarded as a highly IT-demanding discipline.

### 1.2 Reforms in Geomatics Courses

Apart from these external changes that may affect the intake of students, the LSGI Department has also gone through stages of restructuring. Formerly, it was the Centre of Land and Engineering Surveying, offering 3-year Higher Diploma (HD) courses majoring in Land Surveying and Cartography for the years 1984 to 1991 intake. Only AL science students who had taken Physics and Mathematics were admitted to the course. With the growth of the Centre to the present Department, newer and more advanced courses at undergraduate and post-graduate levels were introduced. Since 1991, the first intake of the Bachelor of Science (BSc) in Land Surveying and Geo-Informatics started to accept both AL science and arts students with preferences of some subjects such as Physics, Mathematics, Geography and/or Computer Studies. There has been no strict requirement of whether these examinations should be taken in English or Chinese. On the other hand, the 3-year HD was restructured to a 2-year course of HD in Land Surveying in 1992, and there to HD in Geomatics in 1998. Admission requirements are similar to that of BSc course except allowing a lower academic attainment.

The introduction of new and replacement of old courses are of course accompanied by series of curriculum changes which are brought by changing demands in the profession and the society. Two major aspects of curriculum reform are envisaged. First there is a broadening of subjects related to land surveying like remote sensing, photogrammetry, geographic information system, digital mapping, all of which incorporate a substantial proportion of automation/computing technology element. This might imply a higher successful rate of academic achievement for those students with a computing background knowledge. Second, as conformed to general university and societal requirements, the curriculum should also cover subjects beneficial to the well-being of students like language subjects, general education. Within the two or three years time constraint, the balance or dilemma between the depth and diversity of knowledge that could be transferred to students certainly needs further investigation. In addition to these curriculum changes, students' language ability is also a major concern with the explicit University policy of lecturing and tutoring in English.

Internally, these changes were necessary for the Department to adjust to the global broadening of the profession of Land Surveying to Geomatics. Externally, the Department must respond to the changing philosophy in university education as a whole. Hence, more general and civic educational type of subjects have to be incorporated into the curriculum. At this point, it might be interesting to see if these changes during the last five years or so have affected any progress and quality of our graduates. In addition, the credit-based programme introduced these two years, which brings Higher Diploma and BSc students together in some subjects, will offer a new challenge in teaching and learning not encountered before.

Besides, as a professional programme, our curriculum must match with the demand of the industry. In the past, almost all our graduates found jobs in the field of land surveying. Recently, the job prospective of our graduates has expanded, notably in the area of Geographic Information Systems. At the same time, opening of career opportunities in Mainland China and the increasing number of international projects demands a more

global outlook of our curriculum and our graduates. It would be useful to know if our graduates are prepared for these new changes. The type of continuing education and post-graduate courses taken by our graduates could reflect deficiencies in our curriculum and the changing job market.

The changes in the three stages of geomatics education (pre-university, university, and post-university) affect each other in a rather complex manner. This study will hopefully shed lights on how they interact and provide guidelines on developing learning and teaching strategies for the Department to meet the challenges ahead.

## 2. Methodology

Both qualitative and quantitative approaches are taken to assess the changes and factors mentioned in the previous section. A questionnaire is sent to all graduates of HD and BSc courses in which questions are related to four main areas:

a) personal particulars, university entrance examination results with details of subject breakdown, and academic attainment at graduation;

b) secondary (pre-university) school education in terms of subject types and medium of instruction;

c) opinions regarding curriculum offered by LSGI Department and any pursual of related further studies; and

d) career after graduation, especially on their relevance, prospects and achievements.

As supplementary information, employers' views on the performance of identified students are also solicited. The employers are asked basically about expectations of graduates in terms of professional skills, language communication and personal characters in 17 questions. They then have to indicate whether the identified student(s) whom they has/have employed can fulfill these expectations.

In summary, the collection of information of a student from pre-university stage to graduation and even to employment stage allows us to have a complete student profile (from freshman to a fully qualified professional). Analyses will be made in two temporal dimensions. Horizontally, students of the same year are compared to investigate the preferred entrance requirements for the geomatics course. Hence, correlation is made between the academic attainment of selected subjects in public examination and the attainment of grades/honours classification upon graduation. Vertically, comparisons are also made between students of different years, with a view of assessing the impact of changing educational policies on geomatics candidates and students qualification. This paper only highlights the findings of the horizontal dimension. The results are important to assist the Department in drawing specific requirements for entrance into the HD and BSc courses. There are several assumptions about students quality in mind around colleagues in the Department but these have never been tested. A small sample of these hypotheses includes:

a) Science students perform better in our courses.

b) Students who have taken AL examination perform better in our courses.

c) Students with a higher grade in English are more successful academically.

d) Students taking more general subjects in secondary schools and universities are more successful in their careers.

## 3. Results and Analysis

The returned and valid questionnaires constitute a sampling size of 41% for the BSc graduates and 30% of the HD graduates which are statistically acceptable. As information for interpreting the statistical results, BSc graduation honours are classified into first class, second class upper, second class lower, third class and pass; whereas HD students will obtain either a grade of distinction, merit or pass. In case students fail in their final year examination and do not want to continue retaking the failed subjects, a 'failure' grade will appear. The first part of this section will analyse what constitute an ideal or preferred candidate to geomatics education. This includes correlation between AL subject grades and the academic attainment at graduation. The second section will touch on what constitute a preferred geomatics graduate for the profession. Feedback from both the graduates and their employers are at large taken into consideration.

### 3.1 Preferred Candidates

Figure 1 shows the correlation between students' individual subject attainment and their graduation classification for both BSc and HD courses. The following patterns (Figure 1) are revealed:

a) There is no strong evidence to show that students from a science or arts background would have a more remarkable results over one of the other. This may be because the first year curriculum has been designed to provide remedial classes of Physics and Mathematics for the arts group and Geography for the science group. Besides, both skills residing preferably with the science students (like calculation) and with the arts students (like writing) are equally necessary among the different subjects in the geomatics curriculum. This therefore implies that the first hypothesis in Section 2 is not valid.

b) Similarly, there is also not much difference between students taking and those not taking computing subjects before entering university. The reasons may be that simple and basic computing knowledge in secondary schools can be taken up fairly quickly in the first year curriculum, supplemented by more practical works in later years.

c) A slightly different pattern of correlation is found with the language consideration. For both courses, students with a higher AL/ASL Use of English grade usually perform better throughout the course. This is a logical result as the medium of instruction and examination for all geomatics subjects is English. Besides, unlike other subjects mentioned in the previous two paragraphs, improvements in a language needs a more lengthy period of practice in various aspects like writing, speaking,

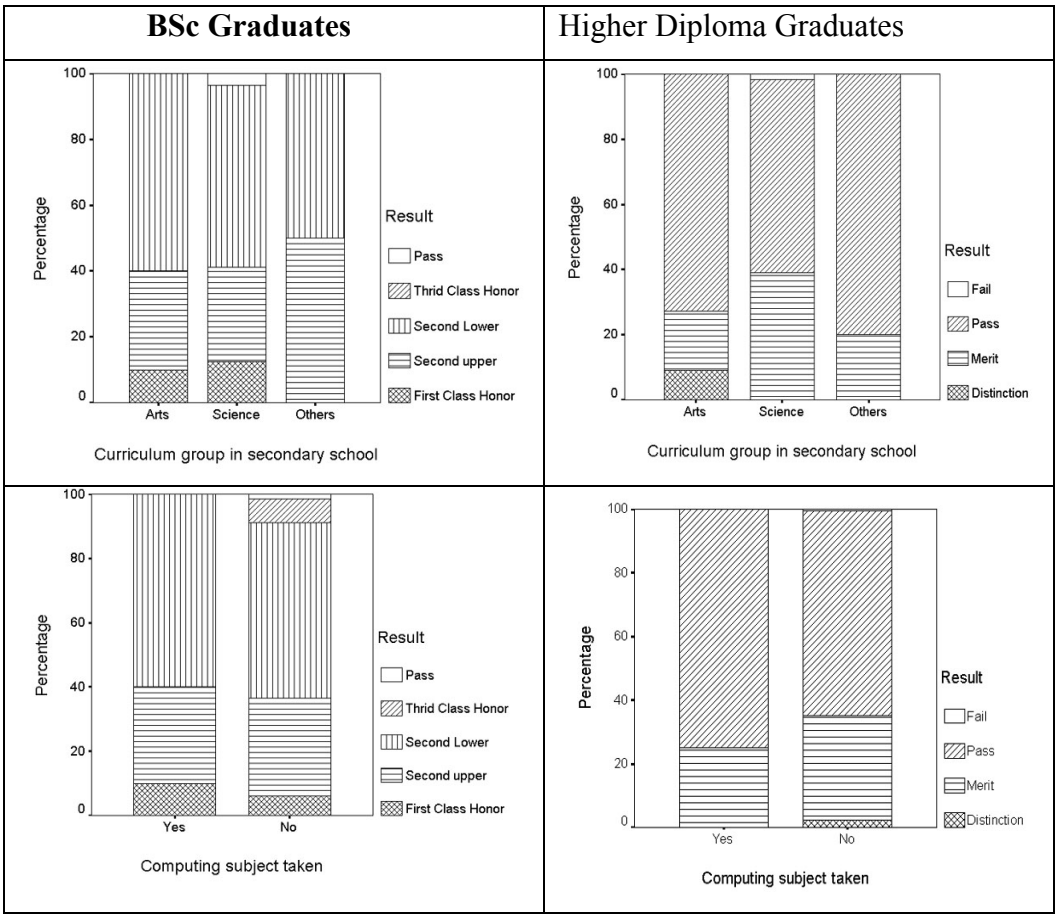
listening etc. The first year university English course may not be adequate to fully supplement students' weakness in English.

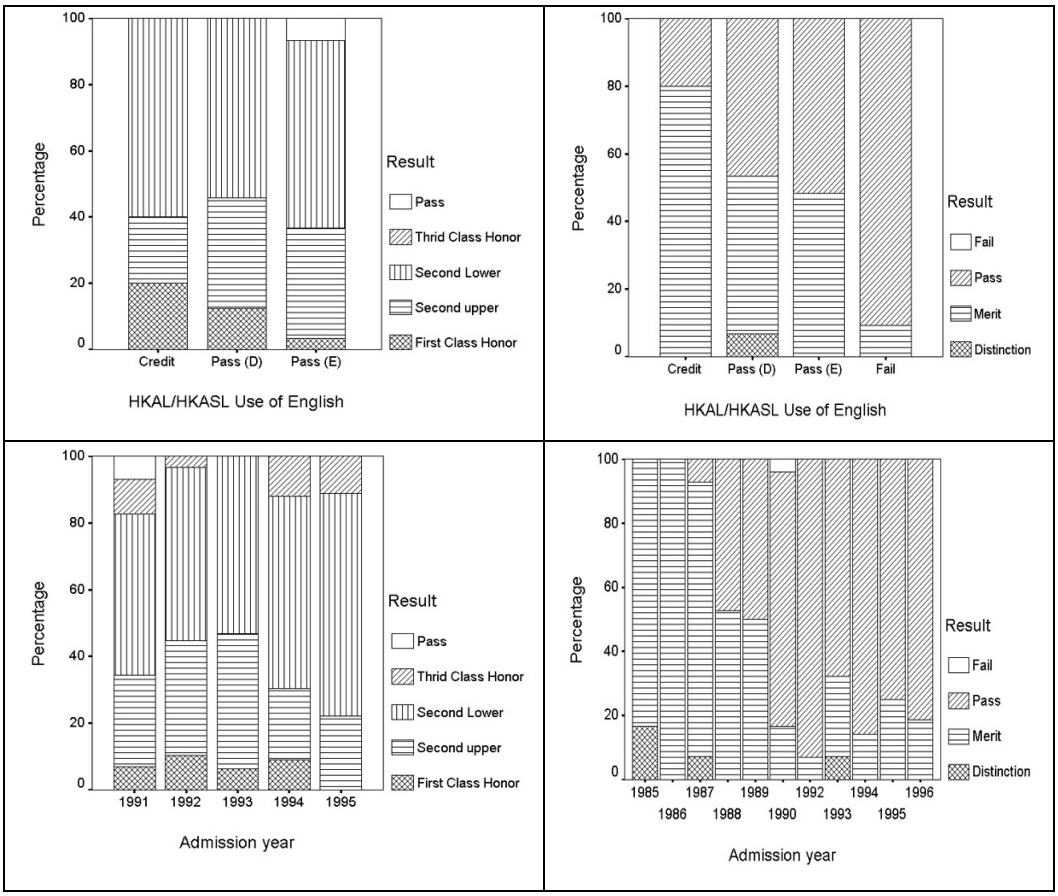
d) The results also show that students not taking AL/ASL examination (i.e. students not taking the two years of pre-university or matriculation studies, and they are classified as 'others' in the figure) are generally average or even below average in their academic performance.

e) Lastly, the intake of students in 1994 and 1995 show a lower performance compared to those in previous years. Whether this is attributed to the introduction of ASL examination - one with a more diverse but simplified curriculum, is noteworthy of further investigation by education policy makers.

These findings may not be totally conclusive but at least show a better indicator of merely relying on the total score of public examination results for identifying our preferred candidates. In addition, if students' quality affecting their studies are known, more prompt action can be taken by the Department to enhance students' performance and confidence.

**Figure 1** Quantitative analysis of secondary school information and university award.






### 3.2 Preferred Graduates

This part mainly deals with how employers would view our students and how students would view themselves as preferred graduates. These are the open-ended questions asked from the graduates: "Do you think the course was related to your career?", "Do you think the course content was sufficient to handle your job?" and "Do you think the course subjects were balanced in different aspects of disciplines?". Most of the responses belong to either one or more of the followings arising from their working experience or demand in geomatics field:

a) GIS curriculum needs to be expanded compared to that of surveying;

b) more surveying practical exercises, IT and programming skills and hands-on experience of updated surveying and GIS software are certainly required compared to basic theory and concepts taught in lectures;

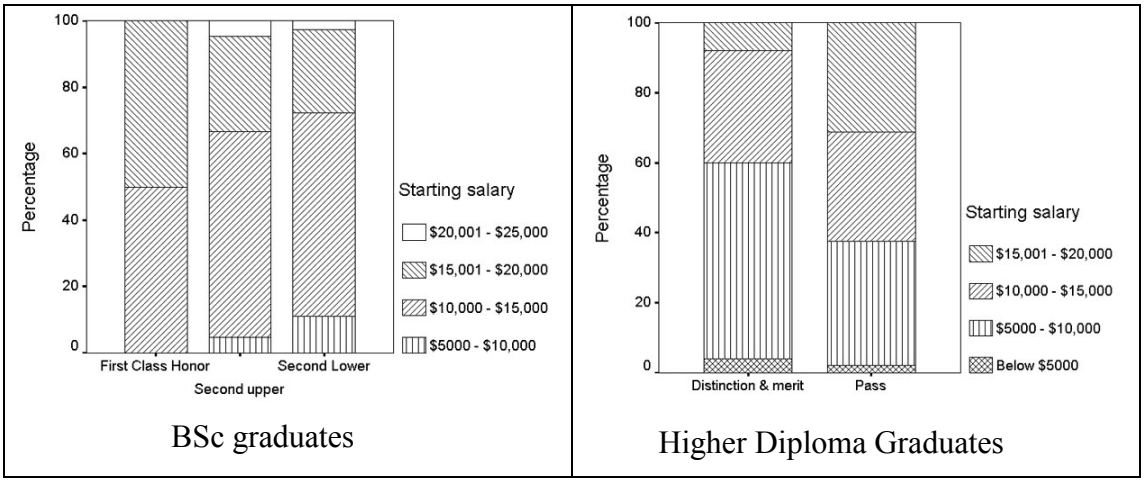
c) other business skills like management techniques, financial control are also necessary; and

d) a few even point out the importance of language subjects but with a less emphasis on other general subjects like Physics, Public Administration.

In fact, employers share similar views with the students. In addition, they would demand a more independent and strong personal character - an employee who can take up

responsibility, learn by himself or herself and possesses analytical thinking. Some also express the concern of employees being able to communicate and express themselves fluently in both spoken and written English. One interesting thing to note is that no positive or negative correlation exists between academic awards and salary of graduates' first job (Figure 2). However, there is a greater intention for graduates of higher academic awards to pursue further studies in the related geomatics field like GIS, management, IT and computer programming. These are the areas that they find insufficient in their undergraduate studies but are highly on-job demanding.

**Figure 2** First job salary and university award.




These seemingly negative criticism have in fact become positive comments. All the then interviewed students were graduated on or before 1998, the time when both the BSc and HD course curricula were not yet revised and were still heavily surveying-based. Ever since the adoption of credit-based system in the University in September 1998, there are a more balanced and diverse geomatics curriculum for the BSc course which includes surveying, remote sensing, photogrammetry, GPS, cartography, GIS, spatial database, computer programming and so on. For the HD course, students can even specialise in either the surveying stream or GIS stream in their second year of study. That is to say, comments made by our past students and their employers are implemented in this new curriculum. The Department would of course hope to have a positive outcome, that is having a batch of preferred graduates ready for the challenge in the field of geomatics, in the near future.

## 4. Conclusion

With the objectives of identifying preferred candidates to the geomatics education offered by the LSGI Department of the Hong Kong Polytechnic University and producing preferred graduates to the geomatics profession and society, this paper has detailed out how quantitative measurements are made with the different affecting criteria. Analyses are also based on the changing university entrance examination policy in Hong Kong, the

feedback from graduates and employers on the curriculum offered by the Department and their expectations. Only from these various stages of study can we identify a preferred profile of a student, from the time of joining the university to the time of graduation and to his/her career. Finally, it is worth noting that there will be continuing changing educational policy in both the secondary schools and universities especially in the coming few years, like the promotion of teaching in Chinese for non-language subjects, the non-separation of Science and Arts subjects, the introduction of more diverse subjects including IT and humanities and the reforms in all public examinations. In response to these changes, the Department needs to find ways of adjusting to these changes, assessing their impact while maintaining the necessary and good quality of geomatics training for all our students.

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