SOME KEY FACTORS CONSIDERED BY STUDENTS IN ELECTING TO STUDY ENGINEERING

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ABSTRACT

This paper identifies some key factors that influence engineering students in deciding to pursue a primary degree in engineering, and in particular civil engineering, and the student perceptions regarding engineering having completed three or four years of study. An anonymous online survey indicated that the respondents had largely reached the decision themselves to study engineering, cognisant of the breath of available information, citing a long-standing interest in the subject as the key factor. Specialisation after either one or two common years of engineering study rather than direct entry was cited as a very attractive option. In reaching their decisions, the respondents gave a medium ranking to advice from peers; the geographic location/proximity and status of the higher education institution; the career prospects and range of opportunities; the status of the profession and starting salaries. A lower ranking was given to advice from friends; university open days and careers exhibitions; work experience and the course duration and entry requirements.

INTRODUCTION

A skilled workforce particularly in the areas of engineering, science, information and communications technology, and research and development is a prerequisite to maintaining and building a knowledge-based economy. This paper sets out to identify the key factors that influence prospective students in choosing to pursue engineering studies, in particular a primary degree in civil engineering; the student perceptions regarding engineering during the course of their studies and their immediate intentions on graduating. The data was collected using an anonymous online survey directed at the students on the Bachelor of Engineering (BAI) degree programme at the School of Engineering, Faculty of Engineering and Systems Sciences, Trinity College Dublin (TCD).

CASE STUDY

The School of Engineering at TCD comprises the Departments of Civil, Structural and Environmental Engineering, Mechanical and Manufacturing Engineering, and Electronic and Electrical Engineering. The primary aims of the four-year BAI degree programme are to produce engineers who are adaptable and who will readily learn new approaches, applications and techniques. Entry to the BAI programme is un-denominated. All of the students are given an introduction to the different engineering disciplines and a good foundation in fundamental engineering concepts, principles and methodologies during the first two years of the programme. The students choose to specialise in one of five engineering disciplines in the third and final years. About 170 students are accepted onto the BAI programme annually and around 55% of these students currently choose to specialise in civil engineering. The first year serves to

consolidate the study of mathematical and physical sciences. In the second year, the subjects that are common across the engineering disciplines are studied to progress associated mathematical knowledge and skills; to develop the ability to formulate, analyse and synthesise solutions to a broad range of basic engineering problems and to introduce the skills of carrying out engineering design projects. Students opting for civil engineering then continue their studies in the Department of Civil, Structural and Environmental Engineering for the third and final years of the BAI programme which are designed to ensure a sound understanding of scientific and engineering principles and their application to the solution of practical and theoretical problems in the broad range of fields encompassed by civil engineering. The third year syllabus is compulsory; the fourth year contains some options.

SURVEY METHODOLOGY

The students surveyed had successfully completed the first two years of the BAI programme and at least one year of further study in the Civil Engineering stream. An electronic mail, which included a link to an online survey, was circulated to the BAI Civil Engineering stream students in the 2004/05 academic year. The data was gathered using the online compiling service at www.surveymonkey.com. The students were invited to complete the anonymous online questionnaire shown in Table 1. The breakdown of the classes by student numbers and gender are listed in Table 2.

Question 1: Why did you choose this branch of engineering?

- Job Prospects
- Engineering background (family)
- Range of career opportunities (design office, on site, manufacturing, etc..)
- Always found it interesting
- Experiences from first two years of BAI course
- Other (please specify)

Question 2: How did the following rate in your decision to choose engineering? Rate from 1 (Not Influential) to 5 (Extremely Influential)

	Not influential				Extremely influential
Advice from teachers					
Career exhibitions					
STEPS programme (IEI)					
Advice from friends					
3rd level open days					
Previous summer employment in the industry					
Guidance counsellor					
Advice from parents					

Question 3: How did the following rate in your decision to start the BAI program?

	Not important				Extremely important
Long term career prospects					
Interest in engineering					
Job opportunities					
Starting salary					
Status of profession					
Length of college course					

Question 4: Any other major factors which influenced your decision?

Table 1. Online survey.

Question 5: **What is the main reason you chose to study at TCD?**

- No. of points required to gain entry
- Location of college
- Common entry (First two years)
- Status of TCD
- Other (please specify)

Question 6: **Would you advise Leaving Cert students to consider studying for an engineering qualification at 3rd Level?**

- yes
- no

Question 7: **On graduating what are your immediate intentions?**

- Gain immediate employment in an engineering role
- Further engineering studies
- Further studies in another profession
- Travel
- Other (please specify)

Question 8: **If you were filling out your CAO form again would you choose an engineering course?**

- yes
- no

Question 9: **Please give reasons for your answer above, indicating what your other choice may have been.**

Table 1. Online survey (continued). Note that the CAO form referred to in question eight relates to the application form submitted by prospective students to the Central Applications Office (Ireland) [1] for admission to first year undergraduate courses in the Republic of Ireland.

Class	Number of students	Male (%)	Female (%)
Third year	94	77.7	22.3
Final year	99	77.8	22.2

Table 2. BAI Civil Engineering stream, 2004/05.

SURVEY RESULTS

A total of 108 responses, representing 56% of the total 193 students invited to complete the survey, were received and compiled online. The data are summarised in Figures 1–6. Note that rankings of one and five in Figures 2 and 3 indicate ‘not influential’ and ‘extremely influential’, respectively.

ANALYSIS

In general, the respondents appeared to have been well informed, having considered a broad range of factors in reaching their decisions to study engineering. Overall, the respondents gave a medium ranking to the advice received from their peers (parents, teachers, guidance councillors)

and a slightly lower ranking to the influence of general media, friends, university open days and careers exhibitions (Figure 2). Work experience was also given a low ranking presumably because the vast majority of the students had entered the BAI programme directly on completing their second level education.

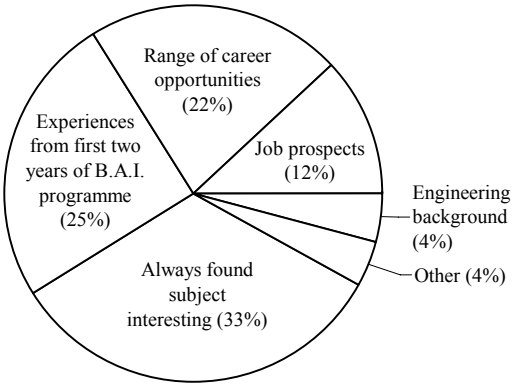

Figure 1. Reasons for choosing Civil Engineering stream.

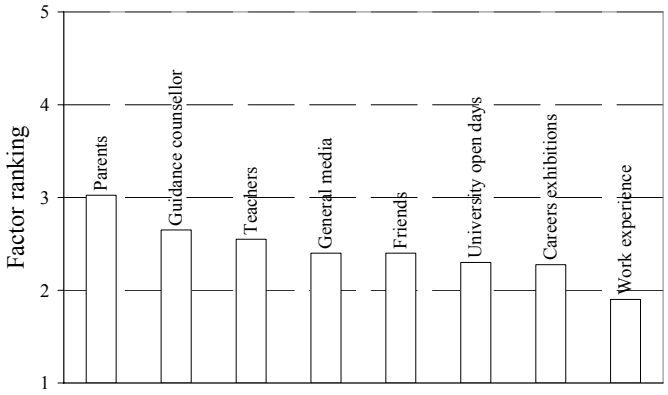

Figure 2. Sources of information considered by students in electing to study engineering.

Overall, the low to medium rankings of these factors (Figure 2) suggest that, cognisant of the breath of available information, the respondents had largely reached their decision themselves to pursue engineering studies citing a general long-standing interest in engineering as the key factor (strong ranking, Figures 1and 3): ...*"enjoyed the course and the sector of work that it leads too"*.

Other factors influential to the decision to study engineering were the appeal of the broad range of career opportunities; long-term career prospects and the rewards afforded by an engineering qualification (medium to strong rankings, Figures 1 and 3): *"... find the course challenging but capable and career opportunities are good",..."I wanted a degree that would give me a range of opportunities in many professions",..."Engineering is a good degree to have and I can go into other professions later if I want"*.

The starting salary was given a medium ranking (Figure 3) presumably because the graduate starting salaries are currently above average in engineering compared to other professions which suggests a good balance of students who want to enjoy their future careers: ..."*the chance to work all over the world, earn good money, and the constant challenges that engineers face"*.

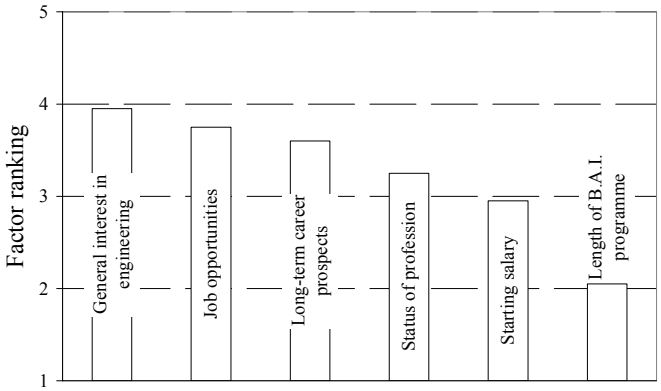

Figure 3. Factors influencing decision

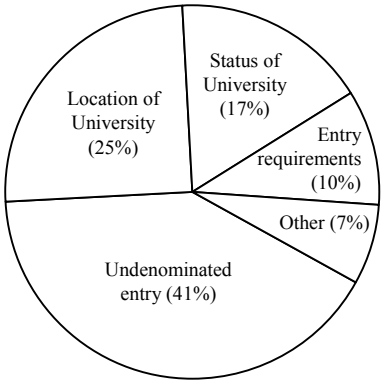

Figure 4. Reasons for choosing to

to study engineering degree. study engineering at TCD. Specialisation after either one or two common years of engineering study was generally preferred over direct entry. The un-denominated entry to the BAI programme was cited as a very attractive feature by a cohort of respondents, presumably because they had decided to study engineering but were unsure about which particular discipline they wanted to specialize: 41% of the respondents cited un-denominated entry as the main reason for their decision to choose the BAI programme at TCD (Figure 4).

A further 25% of the respondents cited their experiences gained during the two common years of engineering study as the deciding factor in specialising in civil engineering rather than electing for one of the other streams available (Figure 1). These findings reinforce the recommendation of McIver Consulting [2] and the Expert Group on Future Skills Needs [3] that the higher education institutions in the Republic of Ireland should move to increase the percentage of engineering degree students recruited through common entry mechanisms. A few respondents suggested a preference for a single common year instead of the two common years on the BAI programme: *… "two years common course is too long, would perhaps choose a course with only one common year in preference to the two common years at TCD".*

Other factors influential to the respondents decisions to choose the BAI programme at TCD were the status and geographic location/proximity (medium to strong ranking) of the university itself with the course entry requirements only given a low ranking in reaching the decision (Figure 4). The vast majority (84%) of the respondents were happy with their decision to study engineering (Figure 6): *…"I have really enjoyed the course and I am very interested in furthering my engineering knowledge"… "Engineering wasn't my first choice but I have found that I like the course and find it interesting".*

Those who, given the choice again, said that they would not have chosen to study engineering cited a lack of interest in the subject; a lack of practical experience gained (too maths based and/or too theoretical) and/or that the course was too difficult/demanding. 8% of the respondents listed architecture as a possible alternative choice to engineering: *…"Engineering didn't turn out to be what I imagined that it was".*

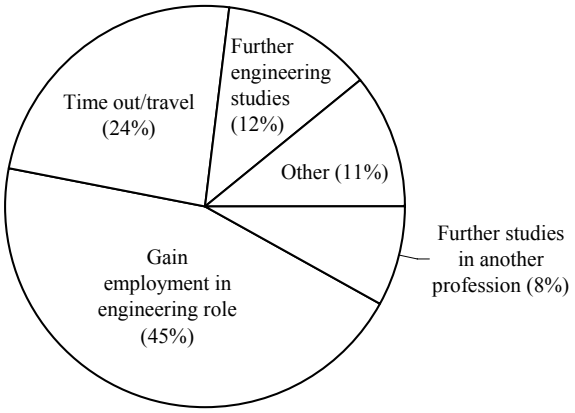

Figure 5. Immediate intentions on completing the BAI degree programme.

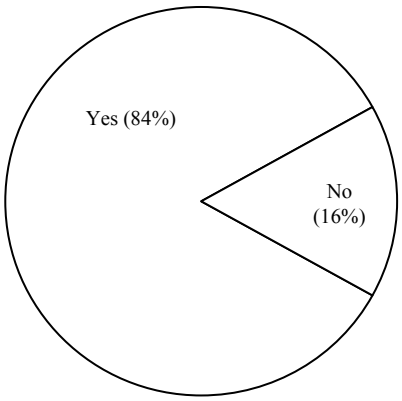

Figure 6. *"Given the choice, would you choose to study engineering again"*

However, the vast majority of the respondents planned on pursuing an engineering career on graduating from the BAI Civil Engineering programme with 45% and 12% of respondents planning on taking up immediate employment in an engineering role and further engineering studies, respectively (Figure 5). Another 8% of the respondents intended on pursuing further studies in another profession to compliment their engineering education while 24% of the respondents planned on taking some time out after graduating. The status of the engineering profession was also given a medium ranking (Figure 3). The length of the BAI programme was given a low ranking presumably because Civil Engineering degree programmes of four-year duration are currently the norm at universities in the Republic of Ireland. A small minority (4%, Figure 1) cited a family engineering background in electing to study engineering themselves.

DISCUSSION

A skilled workforce particularly in the areas of engineering, information and communications technology, and research and development is a prerequisite to maintaining and building a knowledge-based economy and the promotion of these areas to attract a sufficient cohort of talented students for future skills needs is essential. The status of the engineering profession was only given a medium ranking by the respondents in their decision to study engineering and, following from this, presumably a higher status would attract a larger cohort of prospective students. Measures are been actively taken to help promote engineering to students at an early stage in their education and raise awareness about the varied and interesting challenges and career opportunities presented by engineering, science and technology, including:

- Seminars at secondary level colleges in Ireland organised by TCD and other higher education institutions to promote engineering study.
- The Science, Technology and Engineering Programme for Schools (STEPS) [4] run in conjunction with Engineers Ireland [5], the representative voice of the engineering profession and the accreditation body for engineering degrees in Ireland.

The STEPS programme did not feature as an important factor in the survey since it had not been fully rolled out when the survey was conducted. The vast majority of the respondents planned on following an engineering career on graduating from the BAI Civil Engineering programme. However, a cohort of respondents cited the lack of practical experience gained and the course having been too demanding as reasons for not choosing to study engineering, given the choice again. These issues are addressed in the BAI programme by, among other factors, the development and inclusion in the curriculum of more problem-based learning [6] and by actively encouraging the students to take up work placements in industry during the summer vacation periods.

SUMMARY

The 108 engineering students that responded to the anonymous online survey appeared to have largely reached the decision themselves to study engineering, cognisant of the breath of available information, citing a long-standing interest in the subject as the key factor. Specialisation after either one or two common years of engineering study was generally preferred over direct entry. Un-denominated entry was cited as the main reason by the respondents in choosing the Bachelor of Engineering degree programme at Trinity College Dublin. In reaching their decisions, the respondents gave a medium ranking to advice from peers (parents, teachers, guidance councillors); the geographic location/proximity and status of the higher education institution; the

career prospects and range of opportunities; the status of the profession and starting salaries. A lower ranking was given to the influence of the general media; advice from friends; university open days and careers exhibitions; work experience and the course duration and entry requirements. Measures that are been actively taken to help promote engineering to students at an early stage in their education will presumably increase the status of the profession and presumably attract a larger cohort of prospective students in the future.

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