Why engineering, technology, or science?

The views of first-year tertiary students

Report prepared for IPENZ

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1. Introduction and methods

This report describes the findings from a survey of first-year tertiary students in engineering, science, and technology. A brief introduction and an outline of the methodology employed are given below.

1.1 Introduction

In recent years there has been concern that declining numbers of young people are choosing a tertiary education in engineering, technology, or science. This has led to a shortage of qualified people, particularly in engineering, food technology, and IT. The Institution of Professional Engineers New Zealand (IPENZ) aims to encourage more young people to follow this route. It does so through its Futureintech programme, which offers students, their parents, teachers, and careers advisers two major sources of information about careers in technology, engineering, and science. The first is a range of Web-based and print publications, including profiles of young professionals and information about the companies they work for. The second source of information is the young professionals themselves, and over 400 are trained as volunteers to work in primary and secondary schools around New Zealand. Ambassadors play a major part in Futureintech's work as industry role models. Technologists, scientists, and engineers visit classrooms and work alongside students and teachers to support the curriculum. They are able to help students work on projects or towards National Certificate of Educational Achievement (NCEA) standards, facilitating individual and class access to working environments. They attend careers events and presentations, and act as Creativity in Science and Technology (CREST) and science fair mentors.

In order to foster interest in engineering, technology, and science, it is necessary to understand what motivates young people when making choices about tertiary courses and career paths. IPENZ therefore commissioned the New Zealand Council for Educational Research (NZCER) to undertake a survey of first-year tertiary students in engineering, science, and technology, to find out what motivated them to choose these subjects, and what had influenced their thinking about their future careers.

Section 1.2 below explains how the survey was conducted. The next chapter describes the profile of students who responded to the survey, in terms of demographics and educational background. Chapter 3 outlines the studies they are currently undertaking, and Chapter 4 the reasons for their choice. Chapter 5 covers the students' thinking about their future careers; Chapter 6 provides a summary and some concluding remarks.

1.2 Methodology

An online survey was used because it is more cost-effective than a paper-based questionnaire, and also because the target respondents were expected to be regular computer users with ready access to computers at university or polytechnic, even if they did not possess their own PC.

Students wishing to study technology, engineering, or science at tertiary level in New Zealand can choose from more than 500 courses offered by 29 different institutions. In order to recruit a reasonably representative sample, the main task was to make students aware of the survey, and invite them to take part. In order to do this, it was necessary to obtain the co-operation of university administrators who could forward an email to the relevant students. Our goal was to approach at least 5,000 students in a minimum of eight different institutions (four universities and four polytechnics), and achieve at least 1,000 responses.

Over a period of time, the NZCER team made contact with representatives of six universities and eight polytechnics. To begin with, an email was sent to all deans of science and engineering, informing them about the survey and encouraging them to participate if requested. A shortlist of institutions was agreed with IPENZ, and they were contacted and asked if they would agree to forward an email from the researchers (including a link to the online survey) to their students. The exact role of the most appropriate person to do this varied from institution to institution, and in some cases we had to deal with several people before reaching the ones who were able to assist us.[1] No institutions refused to co-operate, but some placed conditions on their participation, and patient negotiation was required in order to obtain their support. Meanwhile, the size and balance of the potential sample was constantly monitored. If at any time there seemed a danger of missing one of our targets, another institution was approached.

In parallel with this process, the online questionnaire was developed. It included mainly closed questions, to enable speedy completion and to minimise the cost of coding. It asked what course students were following, and to what extent various factors had influenced their choice. Building on questions used in previous NZCER research, the questionnaire also explored students' thinking about careers—what the most important considerations are when choosing a career, and what they most hope to gain from it (money? prestige? job satisfaction?). Finally, there were a few brief questions designed to elicit demographic information (age, sex, ethnicity, etc.) and educational background (e.g., school attended, whether they had a scholarship, whether they undertook any extra/summer school courses before coming to university/polytechnic).

The survey went live in September 2008. The original closing date was the end of the month, but in order to meet the needs of one major university, we agreed to extend it until 10 October. As that date approached, we learnt that one polytechnic had only just contacted their students, so a further week was allowed in order for them to respond. We felt that the students would need an incentive to encourage them to participate (given that they would need to complete the

[1] At some universities, it was necessary to enlist the help of more than one person in order to access all of the students we wished to include.

questionnaire in their own time) and therefore entered all completed questionnaires in a prize draw, with five IPOD Shuffles as prizes.

After the survey data had been cleaned and checked, we had completed responses from 1,148 students. It is impossible to calculate a precise response rate, as we do not know exactly how many students were invited to participate, but we estimate the total would have been between 5,500 and 6,000 students, suggesting a response rate in the region of 20 percent.

Analysis of the responses was undertaken using SAS. Cross-tabulations and chi-square tests were used to identify significant differences between subgroups, according to age, gender, ethnicity, date left school, and main area of study (science, engineering, or technology). The schools attended by the students were linked with information from the NZCER database in order to provide a profile of the kind of schools most likely to supply engineering, technology, and science students to universities and polytechnics.

2. Profile of responding students

As noted in Section 1.2, responses were received from a total of 1,148 students. In this chapter we examine the profile of the sample, using the background information which they supplied. We look first at demographics (gender and ethnicity) and then at their educational background: school attended and what they had done since leaving school.

2.1 Gender and ethnicity

Just over a third (36 percent) of the students were female, and almost two-thirds (63 percent) male. Although this is not an even split, it is more balanced than might have been anticipated, given the nature of the target sample. According to the latest available statistics (http://www.educationcounts.govt.nz/statistics/tertiary_education), women make up slightly more than half of the tertiary students in the natural and physical sciences, and in information technology, but only 11 percent of those in engineering and related technologies. In these three areas taken together (the nearest approximation to our target sample) 31 percent of the students are female.

Analysis of ethnicity was more complex. Students were asked to say which ethnic groups(s) they identified with. They were given a choice of NZ European/Pākehā, Chinese, Indian, Māori, Pasifika, or "Other". Eight percent identified with two or (in a few cases) three groups. A substantial minority (18 percent) selected "Other" and typed in their ethnic group. These were analysed in order to provide a fuller picture of students' ethnic background. The existing categories were broadened, and three further categories were added. The results are shown in the first column of Table 2.1. Two-thirds of the students were NZ European/Pākehā or Other European. More than a quarter were of Chinese, Indian, or Other Asian origin, but only 6 percent were Māori and 3 percent Pasifika.

A "prioritised ethnicity" was determined for each student, so that (for analysis purposes) they could be counted as belonging to one group only. Results are shown in the second column of Table 2.1. Students who had identified more than one ethnic group were assigned according to a rule which places minority ethnic backgrounds above Pākehā (the priority order is Māori, Pasifika, Asian, Other, Pākehā). Thus the proportion of Pākehā students is reduced from 64 to 58 percent, but the proportions in other categories remain very much the same.

Table 2.1 **Ethnicity**

Ethnic group	Ethnicity (n = 1,148) %	Prioritised ethnicity (n = 1,148) %
New Zealand European/Pākehā	64	58
Chinese	13	13
Indian subcontinent	7	7
Other Asian	6	6
Māori	6	6
Other European	4	3
Pasifika	3	2
Middle Eastern	2	2
Other	2	2

NB: Percentages in column 1 add to more than 100 because multiple responses were possible.
Percentages in column 2 do not add to 100 because of rounding.

Students were not asked to specify their age; for our purposes the only relevant distinction was whether or not they were mature students (see Section 2.2 below).

2.2 Educational background

Students were asked to say where they had attended school, and to specify the name of the school if it was in New Zealand. A third did not name a New Zealand school, and it can be inferred that at least some of these received most or all of their school education overseas.

Types of school

For the students who had attended school in New Zealand, we were able to link the schools named with information on NZCER's schools database, to obtain the school characteristics, and see what types of school were most likely to send students on to engineering, science, or technology courses in tertiary education. The proportion of students from each type of school was then compared with national data (Table 2.2).

Table 2.2 **Type of secondary school attended**

School	National %	Sample (n = 764) %
Decile		
Decile 1–2	11	5
Decile 3–8	60	58
Decile 9–10	24	35
No decile provided	5	2
Type		
Composite	13	6
Secondary Years 7–15	19	13
Secondary Years 9–15	68	81
Gender		
Co-educational	72	73
Girls' schools	15	13
Boys' schools	13	14
Authority		
State: Not integrated	77	87
State: Integrated	15	8
Private	8	4

NB: Some columns do not add to 100 because of rounding.

As might be expected, the students tended to come from higher decile schools. Nationally, 11 percent of students are in decile 1–2 schools, but only 5 percent of the sample came from these schools. By contrast, more than a third of the students came from decile 9–10 schools, compared with only 24 percent nationally.

More than four-fifths of the sample, compared with two-thirds nationally, attended secondary Years 9–15 schools. There has been a recent trend towards Years 7–15 schools, and when these students started secondary school the proportion in Years 9–15 schools would have been higher than it is now, although not as high as 81 percent. Private schools and state-integrated schools were slightly underrepresented in the sample.

Individual schools

It was also interesting to examine the individual schools from which students came to do tertiary courses in science, engineering, or technology. Given the size of the sample (specifically, those naming a school), and the number of secondary schools in New Zealand, we might expect there to

be on average one or two students from each school. Obviously this is a simplification, since school size needs to be taken into account. Even so, the range was surprising.

The students came from 213 of the 474 New Zealand secondary schools, so more than half of the latter were not represented. While 112 schools did send the expected one or two students, 75 sent three to six, and 26 schools sent seven or more students, including three schools which were each named by 20 or more students. Not surprisingly, these were large schools, including the one with the largest school roll in New Zealand; they were also situated in the area where a large proportion of the students were studying.

When left school

Students were asked to state the year in which they left school (Table 2.3). The purpose of the question was to distinguish two groups: on the one hand, those who had left school, perhaps to enter permanent employment, and only later decided to apply to university or polytechnic; on the other hand, students who had left school with the intention of going on to tertiary education, either immediately or following a gap year. For ease of reference the former group are referred to in this report as "mature students", although they may of course be still quite young; the latter group are collectively termed "school leavers" regardless of whether or not they had a gap year before entering tertiary education.

Table 2.3 **Year students left school**

Year left school	Students (n = 1,148) %
2005 or earlier	27
2006	10
2007	59
2008	3

NB: Column does not add to 100 because of rounding.

Over a quarter of the respondents were classified as mature students, as they left school in 2005 or earlier. Those who left in 2007 (or, in a very few cases, early 2008) must have gone straight to university or polytechnic, and those who left in 2006 presumably had a gap year before doing so. We have used this as a variable to explore differences between the two groups.

Mature students were more likely to be male (71 percent), compared with the whole sample (63 percent male). They were less likely to be Chinese (6 percent, compared with 13 percent of the sample).

Students who left school before 2007 were asked what they had done since leaving school; Table 2.4 compares the responses from mature and gap-year students.

Table 2.4 **Mature and gap-year students**

What students have done since leaving school	Mature students (n = 310) %	Gap-year students (n = 117) %
Paid full-time employment/work	70	29
Studied and got a qualification	34	16
Studied and got no qualification	28	37
Gap year/overseas experience	16	24
Family responsibilities	9	3

NB: Percentages add to more than 100 because multiple responses were possible.

Of the "mature" students, 70 percent had been in paid employment; 16 percent said that they had had a gap year or overseas experience (OE), but unless this lasted for at least two years they must have done other things as well. A third had studied and gained qualifications, before beginning on their course, and 28 percent had studied without gaining a qualification.

Of the "gap-year" students, only a quarter said that they had had a gap year or OE; others had worked or studied, activities which could be considered a part of a gap year, depending on how that is defined. Study in this context was less likely to result in a qualification, since it would span only a short period of time.

Almost a third of the students (32 percent) had gained a scholarship to help pay some or all of their course fees. One in six (16 percent) had undertaken extra formal study after leaving school to help them prepare for their course. School leavers (37 percent) were twice as likely as mature students (18 percent) to have a scholarship, but mature students were much more likely to have undertaken formal study to help them prepare for their course (34 percent, compared with 10 percent of school leavers).

3. Current studies

In this chapter we look at what and where students were studying: their university or polytechnic; their subjects; and the qualifications they were aiming at.

3.1 Institutions attended

Five in six (83 percent) of the students in the sample attended university. This is not surprising, as university departments tend to be much larger than those in polytechnics. Even among the universities represented (Table 3.1) the number of students participating varied widely. Almost half of the university students came from the University of Auckland, while Auckland University of Technology and Massey University contributed only a small proportion of the total.

Table 3.1 **University currently attending**

University	Students No.	Students (n = 948) %
University of Auckland	432	46
University of Otago	190	20
University of Waikato	127	13
University of Canterbury	124	13
Massey University	53	6
Auckland University of Technology	22	2

NB: Column 2 does not add to 100 because of rounding.

Table 3.2 shows the polytechnics[2] attended by the remaining students (with the exception of 13 who did not specify where they were studying). Christchurch Polytechnic and the Western Institute of Technology together contributed almost half of the students in this category. One response came apparently from a polytechnic that was not invited to participate; we can only assume that this student clicked on the wrong institution.

[2] For ease of reference, the term "polytechnic" is used throughout this report to include institutes of technology.

Table 3.2 **Polytechnic currently attending**

Polytechnic	Students No.	Students (n = 187) %
Christchurch Polytechnic Institute of Technology	46	25
Western Institute of Technology at Taranaki	43	23
Wellington Institute of Technology	31	17
The Open Polytechnic of New Zealand	26	14
UNITEC Institute of Technology	18	10
Waikato Institute of Technology	16	9
Manukau Institute of Technology	5	3
Otago Polytechnic	1	1
Other	1	1

NB: Column 2 does not add to 100 because of rounding.

Overall, one in six students (16 percent) were in polytechnics rather than universities. There was a marked gender difference: only 5 percent of female students were in polytechnics, compared with nearly a quarter (23 percent) of male students. There were also differences by ethnicity. More than 90 percent of Pasifika, Chinese, Middle Eastern, and Other Asian students were at university, but less than three-quarters of Māori and Other European students. A large proportion of mature students (41 percent) were in polytechnics, compared with only 7 percent of school leavers.

Certain types of school were also overrepresented in polytechnics. More than a third of those from decile 1–2 schools were in polytechnics, compared with 15 percent of those from decile 3–8 and 9 percent of those from decile 9–10. So were 21 percent of those from boys' schools (compared with 10 percent from mixed schools and 4 percent from girls' schools) and 15 percent from state schools (compared with 11 percent from state-integrated schools and 3 percent from private schools).

3.2 Subject areas

Students were asked to specify whether their major, main subject, or specialisation (the terminology varies) was in science, engineering, or technology. Responses are summarised in Table 3.3. It is possible that a programme of study may span two areas, and accordingly 68 students identified two majors. On the other hand, 56 students (5 percent of the sample) did not respond to the question. Just under 10 percent of the students were studying technology; the remainder were fairly evenly split between engineering and science. No students indicated "Other", which confirms that the questionnaire was distributed only to the relevant students.

Table 3.3 **Main subject/specialisation**

Subject/specialisation	Students (n = 1,148) %
Science	48
Engineering	44
Technology	9
No response	5

NB: Column does not add to 100 because multiple responses were possible.

There were very strong gender differences. Nearly three-quarters (72 percent) of the female students were studying science, only 22 percent engineering, and 5 percent technology. Among male students, engineering was the most popular field (57 percent), followed by science (34 percent), and technology (12 percent).

There were also differences by time left school. The most popular area among mature students was engineering (52 percent) while among school leavers it was science (also 52 percent). These two factors are related, as mature students were more likely to be male (see Section 2.2).

Science students were almost all (99 percent) at university, while a substantial proportion of engineering (29 percent) and technology (37 percent) students were at polytechnics.

3.3 Courses and qualifications

Students were also asked to name their major(s), main subject(s), or specialisation(s). Two-thirds of the students (68 percent) named one, 20 percent two, and 5 percent three or more. Eight percent of the students did not respond. Many different courses were listed, and grouping them was not easy, given the evident overlaps and the fact that the exact content of the courses was unknown. The resulting broad classification is shown in Table 3.4.

Table 3.4 **Main subject(s)/area(s) of specialisation**

Subject/specialisation	Students (n = 1,148) %
Civil engineering/environmental engineering/structural engineering/geotechnical engineering	13
Health sciences	13
Computer sciences	12
Biology/microbiology/agriculture/forestry	12
Chemistry/BSc(Technology)/nanotechnology/ biochemistry/biotechnology/pharmacology	10
Mechanical engineering	9
Electrical engineering/electronics engineering/mechatronics	9
Mechanics/structural analysis/physics/electronics	7
Maths/applied maths/statistics/operations research/genetics	6
Other engineering/technology/biomedical engineering/CAD (engineering drafting)	6
Animal behaviour/psychology	6
Earth sciences	5
Land/quantity surveying/town planning	4
Chemical engineering/materials and process engineering/materials science and engineering/product development	3
Software/network engineering/computer systems engineering	2
Architecture/drafting/design for technology/graphics	1
Other	5

NB: Percentages add to more than 100 because multiple responses were possible.

Students were asked what qualification they were currently working towards (Table 3.5). A large majority (81 percent) were working for a first or bachelor's degree; this is not surprising given that five-sixths of the students in the sample were at university. Twelve percent of the students were working for an undergraduate diploma, and just eight students for a certificate at various levels. Seven percent of the students were unsure, or did not respond to the question.

Table 3.5 **Qualification working towards**

Qualification	Students (n = 1,148) %
First (bachelor) degree	81
Undergraduate diploma	12
Certificate level 1	<1
Certificate level 3	<1
Certificate level 4	<1
Other	<1
Not sure	3
No response	4

School leavers (87 percent) were more likely to be working for a degree than mature students (65 percent); conversely, more than a quarter of mature students were working for an undergraduate diploma, compared with only 6 percent of school leavers. Female students were also more likely than male students to be working for a degree (89 percent, compared with 76 percent of males) and less likely to be working for a diploma (only 4 percent, compared with 17 percent of males). Almost two-thirds of students in polytechnics were working for a diploma, and only a quarter for a degree; in universities, nearly all students (93 percent) were working for a degree.

These factors are interrelated, and also linked with subject choice. Ninety-five percent of science students were working towards a degree, compared with 73 percent of engineering students and 70 percent of technology students. Nearly a quarter of engineering (22 percent) and technology (23 percent) students, but hardly any science students (1 percent) were working for diplomas.

4. Reasons for choices

Students were asked about the factors that had influenced their choice of where and what to study. These two questions are of course linked, but priority may be given to one or the other: in some cases the choice of course may determine where to study (especially if it is an uncommon subject, offered by few institutions), in other cases a desire to study in a particular location (near home, for example) may restrict the choice of subject.

Basic frequencies were cross-tabulated with gender, ethnicity, age (when left school), and subject specialism in order to see whether there were any differences in the pattern of responses.

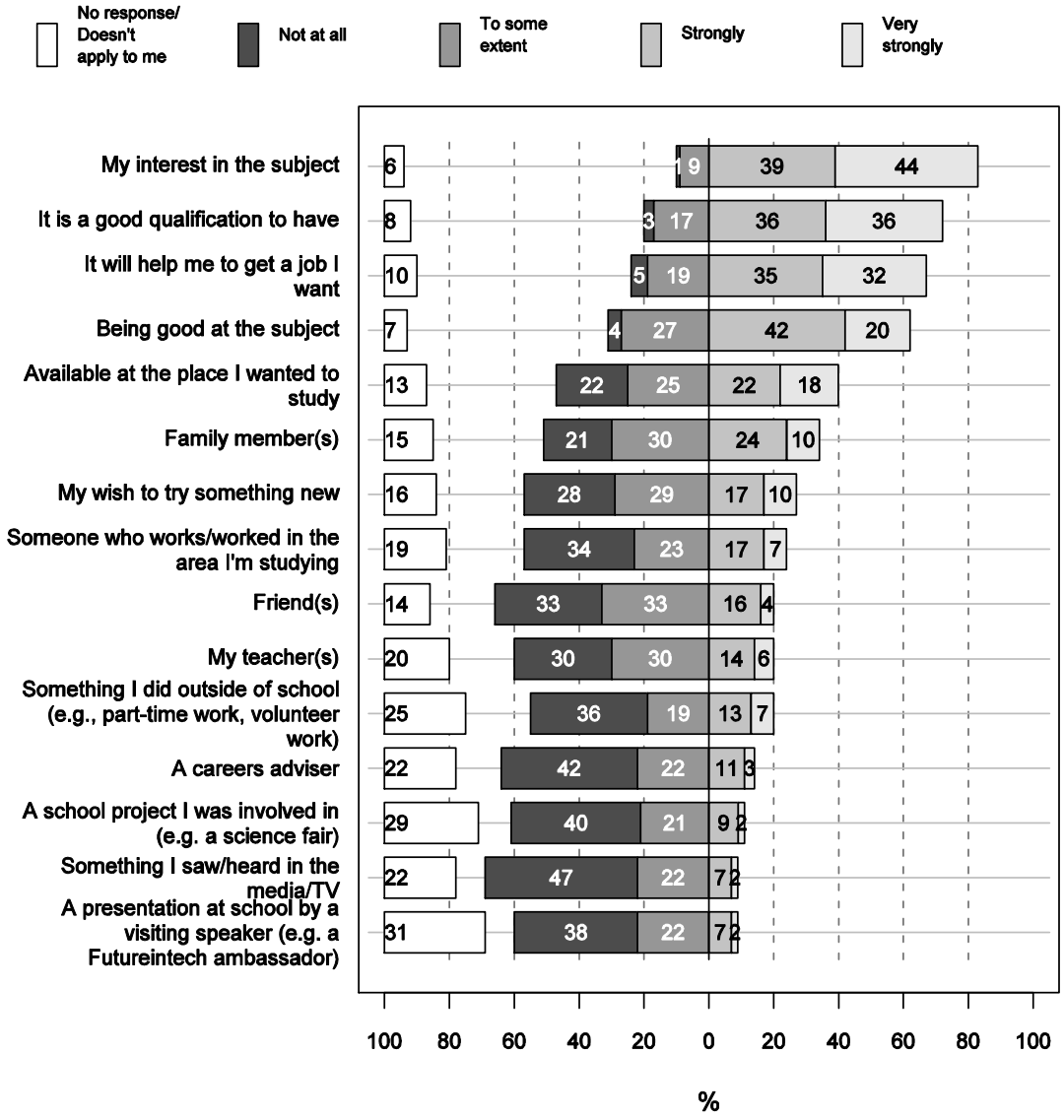
4.1 Choice of subject

Students were given a list of factors and asked to indicate how much each of them had influenced their choice of subject: very strongly, strongly, to some extent, or not at all. It was recognised that some factors would be irrelevant to some students (for example, school-based activities would not influence those who had left school several years earlier) and therefore a "does not apply to me" option was provided.

A summary of responses is illustrated in Figure 4.1. The top four influences (rated strongly or very strongly by over 60 percent of the students) related to the students' interest and ability in the chosen subject, and to its future usefulness (a good qualification to have, will help them get a job).[3] However, it should be noted that while interest and ability assume some familiarity with the subject, more than a quarter of the students were strongly influenced by a desire to try something new.

[3] These are exactly the same reasons given by much younger students in a UK survey for their choice of optional subjects while at school (Lines, McCrone, Schagen, & Benton, 2005).

Figure 4.1 **Reasons for choosing subject**



As suggested above, students' desire to study in a particular location could limit, to some extent, their choice of subject. Thus 40 percent of the students were strongly/very strongly influenced, and a further quarter influenced to some extent, by the fact that their subject was available at the place where they wished to study.

After the factors already mentioned, students were influenced most by people: family members most (a third said strongly/very strongly), then acquaintances who worked in the chosen area, friends, teachers, and careers advisers. One in five were influenced/strongly influenced by something they had done out of school, such as part-time work. School-based activities, and the media, ranked lowest in terms of influencing young people to study engineering, science, or technology. Only 11 percent were strongly influenced by school projects, and 9 percent by presentations they had heard at school, though it should be noted that in both cases nearly a third

of the students indicated “does not apply to me”: either they had left school a long while ago, or they could not recall any relevant projects or presentations.

Students were given the option of indicating influences other than those provided in the list, but less than 10 percent did so, and the reasons they gave related closely to those provided: the desire for a good/better job; the wish to do something useful, important, or challenging; the choice of their strongest subject, or the one in which they were most interested.

Differences by subgroup

In terms of what to study, the only gender difference was that males were more likely than females to be influenced by something they had done outside school (e.g., a part-time job).

There were more differences by ethnicity, although the pattern was not always clear. Indian students were the group most likely to say that they had been strongly influenced by school presentations and projects, by the course being available where they wanted to study, and by family members. The latter distinction was particularly marked: 59 percent of Indian students said they were strongly/very strongly influenced by family members, compared with no more than 35 percent of any other ethnic group. Indian students were also the most likely to mention friends, and someone working in the area, but in these cases there was little difference between them and at least one of the other ethnic groups. Chinese and Other Asian students were also likely to mention friends (Pākehā students were the least likely) and Māori students were almost as likely as Indians to mention someone working in the area.

Help in getting the job they wanted was of almost equal importance to Māori, Pasifika, Indian, Pākehā, and Other European students, but of rather less importance to Chinese and Other Asian students, and of comparatively little importance to Middle Eastern students. Indians were again the most likely to be influenced by the fact that it was a good qualification to have (90 percent strongly/very strongly) but in this case they were closely followed by Pasifika students (85 percent), compared with Pākehā (70 percent) and Māori (72 percent).

Chinese students were the most likely to be strongly influenced by the media (16 percent, compared with Pākehā 6 percent). Indian and Māori students were more likely to have been strongly influenced by a careers adviser (about a quarter of each, but no more than 15 percent of any other ethnic group).

Not surprisingly, there were differences between the “mature students” and the “school leavers” (see Section 2.2 for definitions). School leavers were more likely than mature students to say that they were influenced/strongly influenced by the following factors: being good at the subject; a

project or presentation at school; family and friends; teachers[4] and careers advisers; the media; the fact that the course was available where they wanted to study; and would help them to get the job they wanted. In some cases the difference was pronounced, in some cases less so, and on some of the items the mature students were likely to say "does not apply to me". Mature students were more likely to be influenced by something they did outside school, someone working in the area, and a wish to try something new. As we saw in Section 2.2, the majority had been in employment since leaving school, and presumably their experience there had encouraged them to seek further qualifications and a new career.

Technology students were less likely than others to be influenced by teachers, friends, family members, and being good at the subject; they were more likely to say that these things were not at all important to them. There could be an age-related effect here, as technology students were more likely to be mature students, and as noted above, these factors were less important to mature students.

Engineering students were more likely than others to cite an interest in the subject, a good qualification to have, and it would help them get the job they wanted—not surprisingly, as engineering courses are more likely than science courses to have a direct vocational link.[5] They were more likely to be influenced by family members and friends, but less likely to be influenced by teachers (this could be because a higher proportion of engineering students were mature students). However, they were more likely to be influenced, at least to some extent, by a presentation at school (37 percent, compared with 26 percent of other students).

Science students were more likely than others to be influenced by their interest in the subject, by their teachers, and the fact that their course was available where they wanted to study. They were more likely to be **strongly** influenced by the fact that it would help them get the job they wanted. They were less likely to be influenced by family members, friends, careers advisers, the desire to try something new, and the fact that the qualification they were aiming for would be a good one to have. This fits the picture of the science students as predominantly school leavers, in contrast with the engineering and technology students who included a higher proportion of mature students (see Section 3.2).

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[4] In a survey of Year 13 science students (Hipkins, Roberts, Bolstad, & Ferral, 2006) 44 percent agreed that their teachers had encouraged them to take science, and the same proportion agreed that their parents had encouraged them to do so. In the present survey only 24 percent of school leavers said they had been strongly or very strongly influenced by their teachers, but the proportion of students who were very strongly/strongly influenced by family members was much higher (39 percent). The implication seems to be that young people take more notice of their family than they do of their teachers.

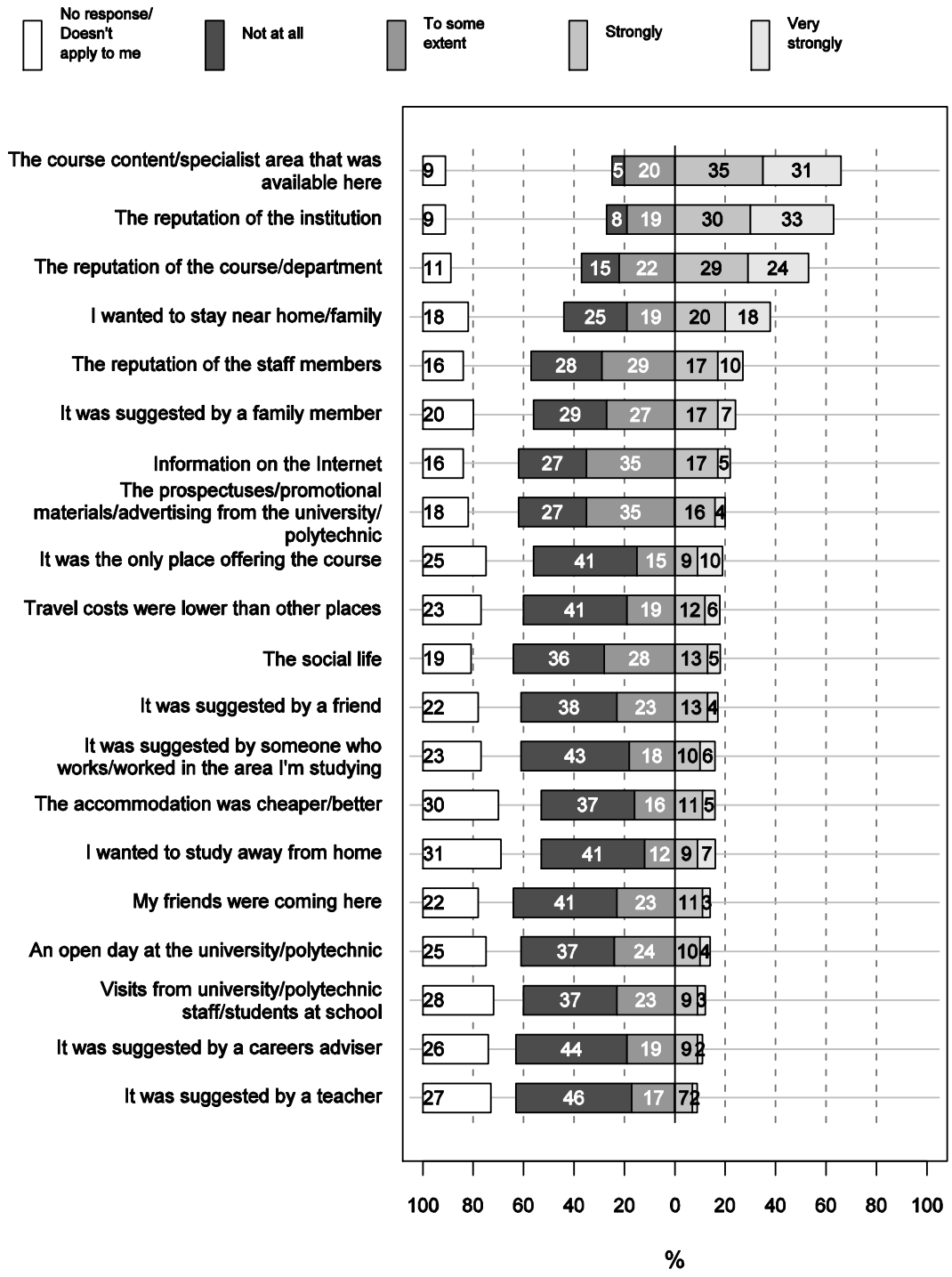
[5] Palmer and Bray (2006) observe that engineering students tend to be particularly career-orientated.

4.2 Choice of institution

Students were asked to rate the importance of a range of factors in influencing their choice of university or polytechnic. As Figure 4.2 shows, the most important factor, which strongly/very strongly influenced two-thirds of the students, and to some extent a further 20 percent, was the course content or specialist area available there. This is to be expected, and it is perhaps surprising that 5 percent said it did not influence them at all. Also highly ranked were the reputation of the institution, the department or course, and the staff members.

Apart from the "academic" factors noted above, students' chief concerns were family-related. Well over half of the students were influenced, at least to some extent, by a desire to stay close to home and family—twice the proportion who were motivated by a desire to study away from home. Suggestions from family members strongly/very strongly influenced a quarter of the students, and influenced another quarter to some extent; suggestions from family members thus rated higher than suggestions from friends, teachers, and careers advisers.

Figure 4.2 **Reasons for choosing institution**



Hipkins et al. (2006) gave their respondents a shorter set of possible factors. “Being near my family” was rated important or strongly influential by about the same proportion in both studies, but other findings differed. More than half of the Year 13 students said that cost was an important factor, while only 40 percent of the school leavers in the current sample said they had been at all

influenced by travel or accommodation costs. More strikingly, 83 percent of Year 13 students rated having fun and meeting people as important, while only 54 percent of the school leavers said that they were influenced "to some extent" or more by the social life at their chosen institution.

Differences by subgroup

Female students were more likely than males to be influenced by the reputation of the institution, prospectuses, open days, and visits from staff or students. It would appear that they did more thorough research before making their choice! Female students were also more likely to be influenced by a desire to stay close to home/family. By contrast, male students were more likely to say that they wanted to study away from home. They were also more likely to say that it was the only place offering their course, and that it was suggested by someone working in the area.

Indian and Pasifika students were more likely than other students to be strongly influenced by the reputation of the institution, course/department and staff members, by open days and prospectuses, and by suggestions from people working in the area. Māori students were the least likely to be influenced by reputation, but the most likely to be influenced by better or cheaper accommodation. Indian students, in this case followed by Pasifika and Chinese, were most likely to be influenced by the desire to stay near home/family, and by suggestions made by family members; Indian and Other Asian students were most likely to be influenced by information on the Internet. The influence of friends (suggestions made by them, or the fact the friends were going there) was felt most strongly by Indian, Chinese, and Pasifika students. Pasifika, Indian, and Māori students were the most likely to be strongly influenced by careers advisers.

School leavers were more likely than mature students to be influenced by all but two of the factors listed. The exceptions were suggestions by people working in the area (more likely to influence mature students) and the only place offering the course (no significant difference between the two groups).

There were also differences by area of study. Science students were more likely than those studying engineering or technology to be influenced by the reputation of the institution or department; by open days, prospectuses, and visits from staff or students; by social life, getting away from home, and the fact that friends were going there. They were more likely to be influenced by suggestions from family members, and less likely to be influenced by suggestions from people working in the area. These differences are consistent with the fact that science students are more likely to be school leavers than students of engineering or technology.

Engineering students were more likely than others to be influenced by course availability, by the institution being the only place offering the course, and by suggestions from people working in the area. They were less likely to be influenced by reputation, open days, visits or prospectuses, friends, or social life.

Similarly, technology students were more likely to be influenced by the institution being the only place to offer the course. They were less likely to be influenced by reputation, and also by wanting to study away from home.

5. Thinking about careers

Students were asked four questions about their future career. The idea was to ascertain how far they had progressed in deciding on a future career, and also what factors had influenced or would influence their career choices.

5.1 Decisions about careers

Students were first asked which of three statements best described their current thinking about their future career (Table 5.1). Only one in five knew exactly what they wanted to do, but more than three-quarters had at least an idea of the general area they wished to work in.

Table 5.1 **Future career plans**

Career plans	Students (n = 1,148) %
Know the general area in which they want to work	58
Know exactly what they want to do	19
Don't know what they want to do yet	14
No response	9

Male students (21 percent) were more likely than female students (16 percent) to know exactly what they wanted to do. Not surprisingly, mature students (27 percent) were more likely to have a definite career plan than school leavers (16 percent). Engineering students (many of whom were mature students, see Section 3.2) were more definite than science or technology students; no less than 52 percent knew exactly what they wanted to do.

Students were next asked which general area they wished to work in (Table 5.2). Responses indicated some degree of crossover between the three areas. Engineering students were the most committed to their current area of study: 83 percent said they wanted to work in engineering, a few intended to switch to technology or science, but most of the others were unsure, or did not respond. By comparison, 69 percent of science students and 54 percent of technology students intended to stay within their current area; 21 percent of the technology students intended to switch to engineering.

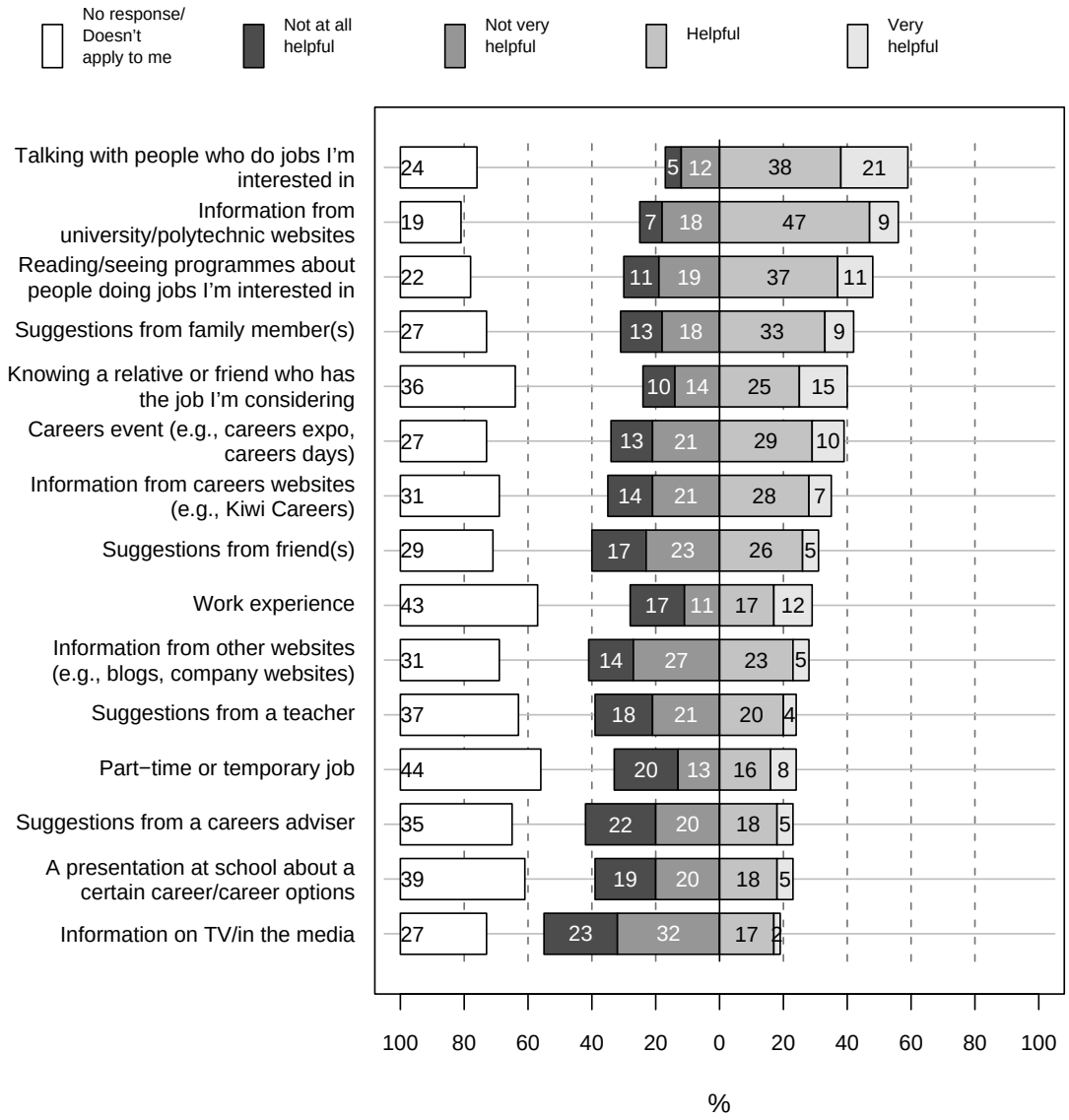
Table 5.2 **Areas that the students want to work in**

Work area	Students (n = 1,148) %
Engineering	39
Science	33
Technology	8
Not yet sure	6
Other	4
No response	10

5.2 Sources of information about careers

Even if they had not yet decided on a future career, students must have given some thought to the subject. They were given a list of sources of information about careers, and asked how helpful each had been to them when they were thinking about career choices. Responses are illustrated in Figure 5.1.

Figure 5.1 **Career information sources**



Three of the top five sources illustrate the importance of gaining information from individuals who have experience of the careers being considered: talking to people who do those jobs, knowing relatives and friends in those jobs, even reading or seeing TV programmes about people who do those jobs. Information from university/polytechnic websites was rated more useful than information from careers or other websites. Suggestions from family members or friends were more likely to be considered useful than suggestions from teachers or careers advisers.

Differences by subgroups

Female students were more likely than males to rate as helpful or very helpful: careers events; presentations at school about career options; information from careers websites; and information from university/polytechnic websites. Once again, it appears that they were likely to do more

thorough research than male students. The latter were more likely than female students to gain information from practical sources: work experience and part-time/temporary jobs (in both cases a larger proportion of female students said "does not apply to me").

As in the question about choice of course (Section 4.1) Indian and Pasifika students were often the ethnic groups most likely to rate sources of information as helpful or very helpful. This was the case with information from careers websites, information from university/polytechnic websites, reading or seeing programmes about people doing the job being considered, suggestions from teachers, suggestions from family members, and careers events (which were also particularly helpful to Chinese students). Information from other websites was helpful to Chinese and Indian students, less so to Pasifika students; information from TV/media was helpful to Pasifika and Chinese students, less so to Indian students.

Work experience was most likely to be helpful to Indian and Other European students. There were marked differences relating to school presentations and suggestions from careers advisers. The former were considered helpful/very helpful by at least a third of Pasifika, Indian, Chinese, and Other Asian students, but by only 18 percent of Pākehā students. Suggestions from careers advisers were rated helpful/very helpful by 41 percent of Indian students, but by 21 percent or less of Pākehā, Other European, Chinese, and Other Asian students.

School leavers were more likely than mature students to be influenced by information from careers websites, information from university/polytechnic websites, reading/seeing programmes about people doing relevant jobs, careers events, presentations at school about career options, suggestions from teachers, careers advisers, and family members. It is, of course, to be expected that they would be more influenced by school-based people and events. Mature students, on the other hand, were more likely to be influenced by work experience and part-time or temporary jobs. (They may have interpreted "work experience" as experience gained at work, rather than the work experience activity provided for school students.)

There were also differences by subject area. Engineering students were more likely to find helpful: information from careers websites; careers events; relatives or friends with relevant jobs; work experience; and suggestions from family members. Science students (mainly school leavers) were more likely to find helpful reading/seeing programmes about people doing relevant jobs, and suggestions from teachers.

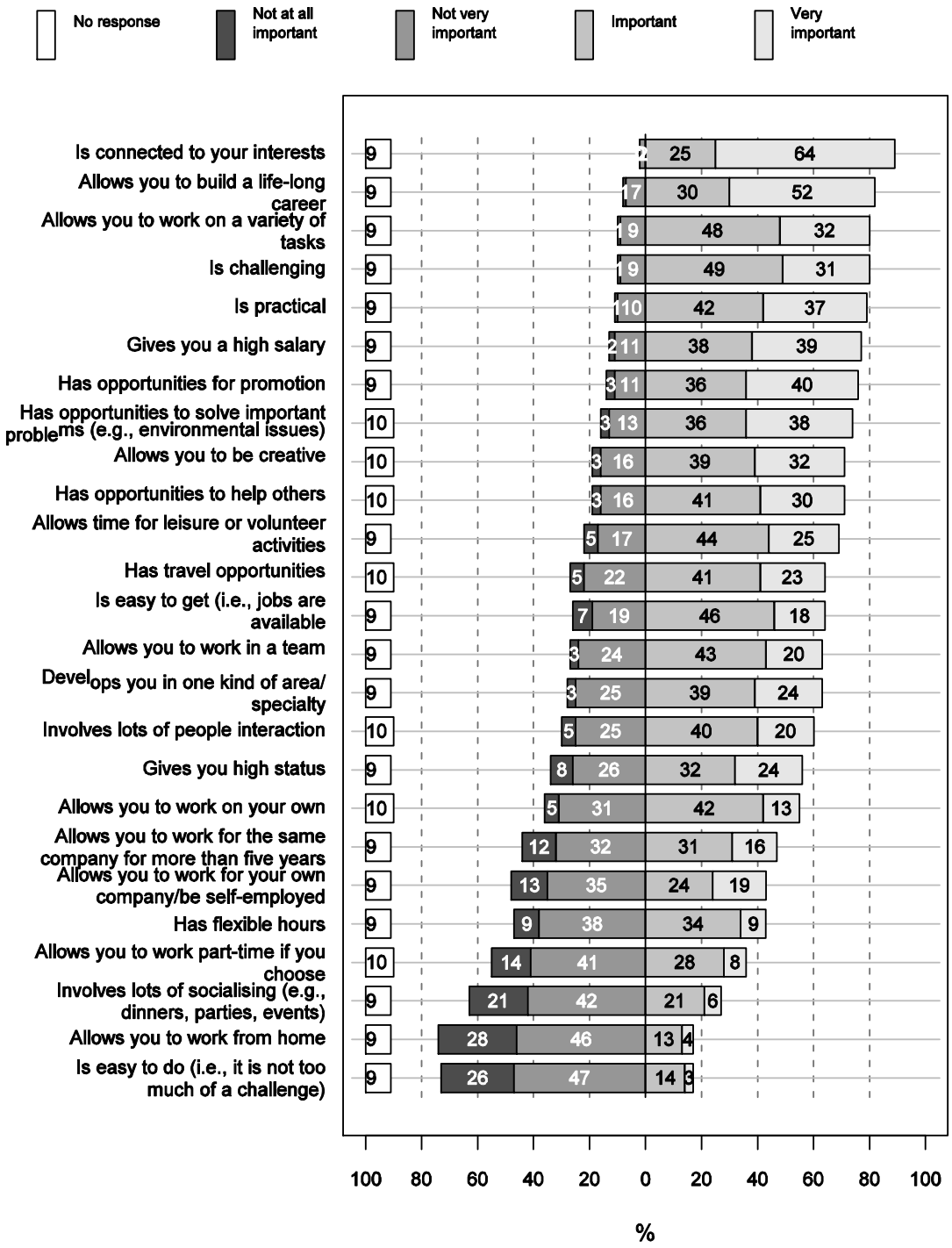
5.3 Important considerations about careers

Students were asked which of a number of possible considerations were important to them when thinking about their future career. Responses are illustrated in Figure 5.2. Not surprisingly, the most important consideration was that the career was connected to the individual's interests—few would want to work in an area that did not interest them. The second most important consideration was the possibility of building a life-long career. It seems that the (mainly) young people surveyed were traditionalist in wanting this; they had not adopted the modern idea of a

mixed portfolio of work. Vaughan (2008) found this was also true of school students aged 16; they defined a career as having a job you can do well, with opportunities to gain more qualifications and build on experience in the same area, and gain promotion in the same workplace. She hypothesises that her sample had experienced the kind of school-based careers guidance that provides information about jobs rather than the development of career management skills, and this may apply also to those who had recently left school.

It was important (or very important) to at least three-quarters of the students that their future career was varied, challenging, and practical; they also wanted a high salary and opportunities for promotion. Helping others and solving important problems were not far below in the list. But students were much less interested in flexible working (including part-time, or from home) and socialising. Only one in six wanted a job that was easy to do: as noted above, the majority wanted the opposite, one that was challenging.

Figure 5.2 **Factors considered when choosing a career**



Differences by subgroups

Some of the gender differences were predictable, others perhaps more surprising. Thus, while female students were more likely to rate as important the possibility of working part-time, the

option of working from home was more important to male students. Male students were also more likely to want a job that was easy to do, gave them a high salary and the opportunity of being self-employed. Female students were more likely than male students to want a job that was easy to get, and would enable them to build a life-long career. Several other characteristics were more important to female students: people interaction; working in teams; opportunities for solving problems and helping others; and time for leisure or volunteer activities.

On this question, as on others, Indian and Pasifika students seemed to rate a greater number of considerations as important, compared with those from other ethnic backgrounds. Indians were the most likely to rate as important/very important: the job being easy to do (37 percent, compared with only 12 percent of Pākehā students and 3 percent of Other Europeans); the ability to work from home (31 percent, compared with 13 percent of Māori students and 14 percent Pākehā); develops you in one area/speciality (76 percent, compared with 57 percent Pākehā); gives high status (77 percent, compared with 52 percent Pākehā and 50 percent Other European). Comparison figures are given when the differences are particularly marked.

Pasifika students were the most likely to rate as important/very important: being able to work part-time (52 percent, compared with 31–33 percent Pākehā, Other European, and Other Asian); the possibility of self-employment (59 percent, compared with 41 percent Pākehā and 24 percent Other European); opportunities for promotion; a high salary; opportunities to help others (85 percent, compared with 67 percent Pākehā and 58 percent Other European); working in teams (78 percent, compared with 61 percent Pākehā and 59 percent Chinese).

Middle Eastern students were the most likely to want a job that was easy to get and which involved a variety of tasks. Pasifika and Middle Eastern students were together the most likely to rate the importance of people interaction (74 percent, compared with 59 percent Pākehā and 47 percent Other European). Chinese, Indian, and Other Asian students were the most likely to want flexible hours, and Pākehā students were the most likely to want a challenge (84 percent, compared with 72–78 percent of other ethnic groups).

School leavers were more likely than mature students to consider the following as important/very important: the job being easy to do, and easy to get; providing high status, and a high salary; having opportunities for travel, and lots of people interaction; having opportunities to help others; time for leisure/volunteer activities; involving lots of socialising. Clearly the young school leavers are looking for the ideal job which provides all of these! Mature students had shorter wish lists; the only thing that they were more likely than school leavers to want was the ability to work part-time.

Science students were the most likely to want opportunities to help others. Technology students were the most likely to value flexible hours, and the ability to work at home. They were the least likely to rate as important/very important: having a job connected to their interests; the ability to build a life-long career; lots of people interaction; variety; opportunities for problem-solving; and for leisure/volunteer work.

Engineering students were the most likely to rate as important/very important: a practical job, involving teamwork and creativity, with high status, a high salary, and opportunities for promotion, self-employment, travel, and socialising.

5.4 School leavers and engineering

Some of the subject differences noted above could be confounded by the differences between school leavers and mature students (who are more likely to be studying engineering, and whose thinking about careers may be influenced by different considerations). We therefore repeated the analysis for school leavers only, comparing those now studying engineering with the others in the sample. Most but not all of the differences noted above were the same. Engineering students who had recently left school were more likely than their peers to rate as important/very important: a practical job; creativity; a high salary; opportunities for promotion; self-employment; travel; and socialising. They were also more likely to mention variety, and lots of people interaction, but they were significantly **less** likely to rate as very important a career involving opportunities to help others.

6. Summary and implications

In this final chapter we summarise the findings from the survey and outline the implications for IPENZ.

6.1 Overall findings

Six universities and eight polytechnics across New Zealand participated in the study. The online questionnaire was completed by a total of 1,148 first-year students (187 from polytechnics, 948 from universities). Just under 10 percent were studying technology, the remainder were fairly evenly divided between science and engineering. Most were working towards a first (bachelor's) degree.

A little more than a third of the students were female. Just over a quarter had left school in 2005 or earlier, and were termed "mature students" in contrast with the "school leavers" who had gone into tertiary education straight from school or after a gap year.

The main influences on students' choice of course related to their interest and ability in the chosen subject, and to its usefulness in terms of a future career. They were also influenced by people, especially family members. School-based people and activities (projects and presentations) were much less influential.

When choosing an institution at which to study, the most important factor was the course content available there, and the reputation of the institution, department/course, and staff members. Suggestions from family members were important in this context also. More than half of the students wished to stay near home/family, twice the size of the proportion that wanted to get away from home.

Only one in five students knew exactly which career they wished to pursue, but more than three-quarters had at least an idea of the area in which they wished to work. The sources of careers information rated most valuable by the students were mainly people-related: information from people already doing the job being considered, or suggestions from family members. Information from university/polytechnic websites was also highly rated.

When thinking about a future career, the most important consideration was the link to the individual's interests, followed by the possibility of building a life-long career. It was also important that the career was varied, challenging, and practical, and that it offered a high salary and opportunities for promotion.

6.2 Differences by subgroup

On all of the questions asked, responses differed significantly by gender, ethnicity, year left school, subject area, and place of study (university or polytechnic). However, it is important to note that there is considerable overlap between these factors, and that one apparently significant difference may simply reflect a difference in responses by a related factor.

There were clear differences between the responses of mature students and school leavers; this is not surprising, because those who left school some time previously would be unlikely to be influenced by school-based people and activities, and their motivation for study and choice of career could be based on very different considerations. Mature students tended to be male, and to study engineering or technology; nearly half attended polytechnics. School leavers, on the other hand, were disproportionately female; nearly all were at university, and more than half were studying science. The profile of these groups is so different that they may need to be considered separately when considering what might encourage others like them to pursue courses and careers in science, engineering, or technology.

In terms of choosing a subject to study, the top three factors were the same for both groups: interest in the subject; the fact that the qualification would help them get a job; and being good at the subject—although school leavers placed much more emphasis on the latter. In general, school leavers tended to name a wider range of factors. They were more likely to be influenced by teachers, careers advisers, family members, and friends. They were also more likely to be influenced by course availability, although this was naturally a high priority for both groups.

For mature students, the desire to try something new ranked fourth highest among factors influencing choice, but it was further down the list of those motivating school leavers. They were also more likely to be influenced by something they did outside school, and by people working in the relevant area.

Choice of course is obviously related to choice of career, particularly in a vocational subject such as engineering. Two of the key factors in determining the former (for both school leavers and mature students) was that it would help them get a job, and that it was a good qualification to have (presumably also for job-related reasons). It is therefore important to see what factors most influence choice of career since this may determine choice of subject to study.

For both school leavers and mature students, the most important factor when considering a future career was that it should be related to their interests. Following this, it should be varied, challenging, and practical, and allow them to build a life-long career. A high salary ranked the sixth most important factor for both groups, though it was mentioned by a higher proportion of school leavers. Also in the top 10 factors for both groups were opportunities for promotion, solving important problems, helping others, and being creative.

Helping others was mentioned by a higher proportion of school leavers than mature students. The same was true of some other factors not in the "top 10": being easy to do and get; conferring high status; providing opportunities for travel and socialising; time for leisure and volunteer activities;

and lots of people interaction. Socialising, for example, was important to almost a third of school leavers, but only 13 percent of mature students. Only one factor was more important to mature students than school leavers: the opportunity to work part-time if they so chose. It seems that school leavers are looking for a career that can provide everything, while mature students no longer expect this, and are more concerned with practical considerations.

6.3 Implications for IPENZ

IPENZ is mainly concerned with young people (those still at school) and supports the Futureintech programme which is designed to encourage students to consider the possibility of a career in engineering. In one respect, therefore, the findings from this survey may seem negative: school-based personnel and activities rank low among the factors influencing choice of subject to study at tertiary level, and also among the sources of careers information considered helpful by the young people. However, "someone who works/worked in the area I'm studying" was a more important influence, and "talking with people who do jobs I'm interested in" was rated the top source of helpful information about careers. Our understanding is that Futureintech, which arranges for young professionals to visit schools and work alongside students in the classroom, can provide an ideal opportunity for such encounters.

Since engineering is a vocational subject, it is likely that young people embarking on a course of tertiary study in engineering have a reasonably clear idea of what they want to do in the future; the survey findings confirmed that this is indeed the case. Engineering students were more likely than others to choose their course on the basis of its usefulness in terms of their future careers. It is therefore important that students, while still at school, are given a clear idea of what career options are available within the engineering field. While some students may go to university and only later decide on a career, tertiary education is too late to foster interest in engineering; career choice needs to be made *before* leaving school, and indeed before subject choices are irrevocably decided.

The analysis of survey findings shows which considerations are important to tertiary students, and especially to those who have just left school, when considering a future career; it is reasonable to assume that the picture would be much the same for students while still at school. Those students who had decided to take an engineering course had a particularly long wish list. Even more than their peers, they were interested in careers offering practical work that was creative and varied, with lots of people interaction; but they were also looking for high salaries, opportunities for promotion and self-employment, travel, and socialising. Presumably they felt that the engineering professions were more likely than other careers to give them at least some of these, so highlighting such opportunities within engineering may encourage similarly-minded young people to follow in their footsteps.

However, in order to increase the proportion of students taking or at least considering an engineering course, it would be necessary to appeal more widely to those who might not have

realised that engineering had something to offer them. In this context it should be noted that three-quarters of school leavers in our sample considered it important to have a life-long career, and one that offered a challenge and the opportunity to solve problems. It is also worth noting that school leavers who felt it very important that their career should provide opportunities to help others were less likely to be doing engineering. Presumably they did not realise that engineering offers such opportunities, and this may be a message that needs to be conveyed.

Our sample was not, of course, a representative sample of all first-year tertiary students; it was restricted to those who had chosen to study science, engineering, or technology. They may, however, be reasonably representative of the young people who (when approaching the transition to tertiary education) are qualified to consider an engineering course, because they are studying subjects which would make them eligible to apply. For students who have made different choices, it may already be too late. The research literature on this subject indicates that children's interest in science tends to begin at an early age, and that to interest them would become progressively more difficult as they moved through the teenage years (Tytler, Osborne, Williams, Tytler, & Clark, 2008). Research also shows that young students may have erroneous impressions of what engineering jobs involve (Lines et al., 2005) and it is vital for misconceptions to be corrected if students are to make an informed choice. For all these reasons, therefore, it is important that work with school students should be undertaken at a relatively early age, before the opportunity of influencing their thinking about engineering is lost.

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