Science at the Crossroads?

A study of trends in university science from Dawkins to now 1989 – 2002

Ian R Dobson
Centre for Population & Urban Research
Monash University

A study commissioned by the Australian Council of Deans of Science
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1. Introduction

Science at the Crossroads is an examination of enrolment trends in Science and Information Technology. It looks at the number of and growth in student enrolments, and the subjects students are studying as components of their university degrees. It considers the period since the reforms in higher education which followed Education Minister John Dawkins' Green and White Papers in the late 1980s.

In 1998/9, The Australian Council of Deans of Science commissioned research into the numbers of Science enrolments and various trends and patterns discernible from an analysis of higher education enrolments. Results were published as *Trends in Science Education: Learning Teaching and Outcomes 1989-1997* (described hereafter as *Trends*) (Dobson & Calderon, 1999). The data showed that between 1989 and 1997, there had been an expansion of over 35,000 enrolments in Science courses, which represented an increase during the period of about 58%. On the surface, this seemed like a very positive outcome, because sector-wide growth had been more modest, at 49%. Since Science was expanding at a relatively fast rate, all must have been well in Australia's Science faculties.

However, from the perspective of Australian universities' faculties of Science, much of this growth had been illusory and was so reported in *Trends*. The teaching provided to many of the new 'Science' students was not being provided by traditional Science departments such as physics, mathematics, geology and chemistry. The growth in Science enrolments had led to increased teaching by non-Science faculty departments, and those which teach psychology (often located in faculties of arts or medicine), and biological Science, (the teaching of which is shared with medical or health Science schools, where these exist). Computer Science had also been a strong growth area, but at many universities, much of the teaching in this discipline is provided by separate faculties of computing or business/commerce. Analysis for *Trends* in fact revealed very restrained growth in several traditional Science disciplines. This situation led to declining enrolments in subjects taught by some departments, and severe financial constraints within faculties of Science, including cutbacks in academic staffing in those departments.

This study is based on analyses of higher education statistics databases. There are fundamental differences in these statistics now compared with those used to produce *Trends.* The next section explains how and why the component fields of study within Science (identified and analysed for *Trends*) are different from the fields of education which comprise the Science of today. Changes in course and subject classifications which took effect from 2001 changed the composition of Science, in terms of both reporting and published statistics. Under one of these classification changes, Information Technology courses moved into their own field of education, separate from the rest of Science. Fortunately, it is possible to identify Information Technology and Science courses separately in both the old and new course classifications. Although there has been continued growth in the sum of Science and Information Technology course enrolments, if Information Technology enrolments are removed, 1997 was the numerical high point in Science enrolments.

Nonetheless, it appears that there has been strong growth in Science (excluding Information Technology) enrolments. Between 1989 and 2002, the number of students enrolled in these courses increased by over 18,000, or 37%. However, sector-wide growth over this period was 64.5%, driven in part by the expansion of Information Technology, for which the rate of growth was 342.2%. Were current trends to continue unabated, there could be more Information Technology students than Science students within two or three years. However, even Information Technology's fortunes might be on the wane.

For *Trends*, the years 1989, 1993, 1997 were the snapshot points used for the analysis. For *Science at the Crossroads*, these three years have been used again as points of observation, and years 2001 and 2002 have been added.

The report starts with an explanation of Australia's higher education statistics, the changes these have undergone in recent years, and the way they have been used here. The report then considers enrolments in the sector overall, before examining the distribution of enrolments between Science, Information Technology and All Other Courses and a detailed analysis of courses within Science. A section devoted specifically to Science PhDs has also been included. The chapter on course completions follows a similar pattern. It is the section on student load which follows which shows the actual change in pattern of science. This particular analysis produces a picture of what constituted a science course in a1989, and how it changed between then and 2002. HECS and Science is considered, this having been the subject of both interest group and media attention in recent years. The possible changes to HECS outlined in the policies of the Government and the opposition Australian Labor Party are also considered. Analysis in the report concludes with a brief examination of science subject enrolments in Year 12. Declining Year 12 enrolments are one of the explanations of declining university Science enrolments.

Data for this exercise were drawn primarily from the Commonwealth Department of Education, Science & Training (DEST)[1]. Since the 1980s, universities have been required to supply very detailed unit record files of their students and staff, initially to the Commonwealth Tertiary Education Commission (CTEC), then to the Commonwealth Department of Education in its various guises. Much as the level of detail required seemed a little excessive at the time, the DEST data gathering system now provides researchers with a rich set of statistics with which to work. This statistics system also provided Australia with the reporting infrastructure which underpins the Higher Education Contribution Scheme (HECS). The university data collections are not perfect, but they produce one of the most comprehensive sets of social statistics available in Australia. On the issue of nomenclature, every attempt has been made to avoid usage of terms with specific definitions in DEST publications, where their usage might cause confusion.

It is hoped that the data collected and analysed for this report will provide both the background for future monitoring and planning, and the starting point for extended analysis in Science and Information Technology at Australian universities**.**

[1] DEST, acronym for the Department of Education, Science and Training is the current name of the department responsible for the Australian higher education sector. In the past it has been known as DEET (Department of Employment, Education & Training), DEETYA (Department of Employment, Education, Training & Youth Affairs) and DETYA (Department of Education, Training & Youth Affairs), but for sake of simplicity in this report, **DEST** is the term which has been used to describe the Department, irrespective of its actual name at various points in time.

2. Higher Education Statistics

Higher education statistics are compiled by DEST staff from series of unit record data files supplied by universities at various times during the year. Universities provide files on courses, university departments, enrolments, student load, past course completions and HECS liability status. From these returns, DEST staff compile aggregated sets of data which are made available to universities and others, and which enable a range of analyses. Although there have been many minor changes to the collection its inception in the late 1980s, some fundamental changes occurred from 2001. The major aspects of these changes are outlined in the paragraphs which follow, but a more thorough exposition has been attached as Appendix 1, including an explanation of how consistency over time has been maintained for this study.

The first change implemented by DEST from 2001 relates to the scope of counting student enrolments. The original methodology was based on the number of students enrolled on the first annual census date, 31 March, and the student load they generated for the whole year. The change was made by DEST in order to include those students enrolled at some stage during the year, but not actually enrolled at the 31 March census date. Perhaps this was done on the grounds that universities now teach for the whole year, rather than the traditional March to November period.

In a sense, there are three ways students might be counted in 2002, two of which are used by DEST in its published statistics:

- the 'whole of year' approach as applied to 2002 statistics counts students enrolled at any time between 1 September 2001 and 31 August 2002, and student load generated by them over this period; this methodology produced a 2002 enrolment total of about 896,000.
- the 'first half of year' approach as applied to 2002 statistics counts students enrolled at any time between 1 September 2001 and 31 march 2002, and student load generated by them over this period; this methodology produced a 2002 enrolment total of about 795,000.

To use either of these total enrolment figures would mean that it was impossible to observe enrolment changes over time consistently. Therefore, the original methodology was used for this study. The original methodology produced an enrolment for 2002 of just under 751,000. It is this figure which would permit time series analysis to match figures in tables produced for *Trends* and the DEST statistical publications produced up until 2001. For a study such as this, where one of the key issues is change over time, it was important to retain the original census-based methodology. In future, comparisons over time, which include years prior to 2001 will be very much more difficult.

The other change implemented from 2001 was to the classifications used by universities when reporting statistical information to DEST on the courses and subjects they offer. Prior to 2001, courses were linked to 'Fields of Study' (FoS), further aggregated into ten 'broad Fields of Study' (plus an additional category for 'non award courses') based on the likeness of the content of those courses. Subjects were linked to 'Discipline Groups', further aggregated into 11 Branches of Learning, based on the likeness of their subject matter. From 2001, both courses and subjects have to be linked into a 'Field of Education' (FoE) classification, which aggregates into twelve 'broad Fields of Education'. The mapping of courses and subjects between the old and new classifications is imperfect.

Science and Information Technology Courses

At the top level, the principal unambiguous change and mapping between the two classifications is that FoS *09 Science* has been split between FoE *01 Natural & Physical Science* and FoE 02 *Information Technology*. In the former classification, FoS *0902xx Computer Science, Information Systems* was a discrete subset of 09 Science, and it is these courses are now classified as FoE *02 Information Technology*. Old and new classifications for the sector are shown in Figure 1:

Figure 1: Fields of Study and Fields of Education (Top Level)

Broad Fields of Study (FoS) Pre 2001	Broad Fields of Education (FoE) 2001 +
01 Agriculture/Animal Husbandry	01 Natural & Physical Sciences
02Architecture/Building	02Information Technology
03Arts/Humanities/Social Studies	03Engineering & Related Technologies
04Business/Administration/Economics	04Architecture/Building
05Education	05Agriculture/Environmental& Related Studies
06Engineering/Surveying	06 Health
07 Health	07Education
08Law/Legal Studies	08Management & Commerce
09Science	09Society & Culture
10Veterinary Science	10Creative Arts
	11Food/Hospitality/Personal Services
	12Mixed Field Programs

Source: Pre 2001: CTEC Field of Study Classification of Higher Education Courses. AGPS, April 1986: 6.
2001+ : ABS Appendices 6 & 7 Obtained in August 2003 from http://www.abs.gov.au

Most of the classification changes need not concern us here. However, in addition to the creation of a new Broad FoE *02 Information Technology*, there are four fields of study from the old FoS *09 Science* which have been redefined out of Science, and three others from non-Science fields of study which have been added to the new FoE *01 Natural & Physical Sciences*:

- the former *09 Science* included Human Movement/Sports Science, Home Economics, Nautical Science and Environmental Science, which are not part of FoE *01 Natural & Physical Sciences* from 2001,

- the former *09 Science* did not include Soil Sciences, Medical Technology, and Medical Science, but from 2001 these have been included within FoE *01 Natural & Physical Sciences.*

It is therefore necessary to accept that for reporting and publication purposes, there has been a re-definition of 'Science', because courses linked to the former FoS *09 Science* do not exactly match the courses now linked to the new FoEs *01 Natural & Physical Sciences* and *02 Information Technology*. However, to ensure that this study was more meaningful, a link was maintained with the aggregations used in preparing *Trend*s.

The classification of courses into Fields of Study or Education is somewhat irrelevant to Australia's Deans of Science, because it has no actual impact on internal university operations. For instance, just because DEST has decided that Human Movement/ Sports Science courses should in future be classified within the FoE *06 Health* does not mean that universities will as a consequence transfer their Human Movement Studies Department from the Faculty of Science to the Faculty of Health Studies. However, it is important to consider other factors, in particular the fact that DEST's published statistics only report the distribution of courses according to the level of broad Field of Education. A casual observer might not realise that the old and new classifications to describe courses in 'Science' had changed so much. Pains have been taken, therefore, to link the former and current Field of Study/Education classifications in an explicable way.

In producing tables for this study, it was imperative that the information presented would ensure that genuine comparisons over time could be made. Bearing in mind the number of enrolments in the broad Fields of Study mentioned above, it was decided to 'expand' the 'Science' reported in *Trends*, on the grounds that both Soil Science and Medical Science retained similar descriptions in the new Field of Education classification, and that Medical Technology in the new classification has been specifically re-designated 'Medical Science'. **Enrolments for these three fields of study have therefore been added to historical figures for Science and reported in *Trends.*** In a sense, history has been rewritten by adding these groups of courses to figures which represent 'Science' in years 1989, 1993 and 1997.

It was further decided that the four former 'Science' fields of study which have been reclassified to fields other than the new FoE *01 Natural & Physical Sciences* have nonetheless been retained as 'Science' for this study. Two of these fields had few enrolments, and have been redefined in the new classification in such a way that they bear little resemblance to their past descriptions (Home Economics and Nautical Science). The third, Human Movement, has been described as 'Science' for this study, despite its reclassification to the FoE *06 Health*. The last set of courses, those in Environmental Studies, reclassified from 2001 as part of FoE *05 Agriculture* have also been described as 'Science' for this study. More universities have Science faculties than agriculture faculties, and it is therefore reasonable to assume that in the majority of universities, environmental Science will be a part of the Science faculty.

Because of the range of provisos and exceptions outlined above, Figure 2 has been prepared to reconcile figures published for years 1989, 1993 and 1997 (as used unequivocally in *Trends)*, and the figures used for all years examined in this study. For instance, there are two fewer enrolments for 1989 using current DEST Aggregated data Sets, than in 1999 when *Trends* was written.

Figure 2: Statistics Reconciliation Chart
Total Enrolments derived from DEST Aggregated Data Files for the Current Study

	1989	1993	1997	2001	2002
Enrolments from DEST data files acquired 2003:	441074	575616	658849	725099	750940
Figures reported in *Trends….*	441076	575617	658827		
Variation (Unaccountable changes in DEST files)	-2	-1	22		
FoS *09 Science* Enrolments reported in *Trends*	60705	83678	95861		
Less: 'I/T' enrolments included (ie FoS 0902xx)	13897	21004	27991		
Net *Science* reported in *Trends*	46808	62674	67870		
FoE 01 Natural & Physical Sciences				54311	55917
FoE 02 Information Technology				56474	61446
Additions to 'Science' for years 1989 - 1997:					
Soil Sciences (from FoS *01 Agriculture*)	44	153	171		
Medical Science (from FoS *06 Health*)	1595	1270	1433		
Medical Technology(from FoS *06 Health*)	231	1675	2365		
Additions to 'Science' for years 2001 & 2002					
Human Movement (now FoE *06 Health*)				4455	4677
Environmental Science (now FoE *05 Agriculture*)				5992	6114
Sub Total	1870	3098	3969	10447	10791
New 'Science' figures, based on Additions:	48675	65772	71839	64758	66708
Information Technology	13897	21004	27991	56474	61446
Science & Information Technology	62572	86776	99830	121154	128154

It was noted in *Trends* that despite the apparent wide range of options available for Science courses in these classifications, many university courses, particularly at the undergraduate level, offered generalist degrees such as the Bachelor of Science (BSc). Although things have

changed considerably in the years since the Dawkins reforms, many 'traditional' universities offered only a limited number of undergraduate courses, and the practice of having a large number of 'courses' was more prevalent in the pre-Dawkins college sector. For example, many universities have offered specifically branded computer Science /Information Technology degrees for only a few years. In previous years, computer Science students at many institutions simply enrolled in a BSc degree, and undertook subjects which saw them graduate with a specialisation in computing. A result of specific course branding in computing and other specific disciplines produces course and enrolment statistics which suggest an expansion of the apparent range of courses offered, without any fundamental increase in the range of subject options available to their students.

The remaining issue is one of nomenclature. In *Trends*, the analysis of 'Science' related exclusively to FoS *09 Science*. In this study, the expressions 'Science' and 'Science courses' have been used to reflect the end result of 'adjusting' FoS *09 Science* (for years 1989, 1993 and 1997), and FoE *01 Natural & Physical Sciences* (for years 2001 and 2002).

For this study, Science and Information Technology courses have been placed into sub-categories for use in enrolments and course completions tables, as shown in Figure 3. There is also one change internal to 'Science' to note: pharmacology, formerly reported in the Field of Study classification within Life Sciences has been moved in the Field of Education classification within Other Natural and Physical Sciences. Consequently it has been adjusted in enrolment and courses completion statistics to the sub group General/Other.

Details of the meaning of the codes can be gleaned from Appendix 1.

Figure 3: Course Groupings used in Tables in this Study

Science & I/T Course Groupings	Field of Study Codes 1989 - 1997	Field of Education Codes 2001 +
General /Other	090101, 090312, 070405, 070501	010000, 019900, 019901, 019905, 019907, 019909, 019999
Life Sciences	090301 – 090399, except 090312	010900-010999, 050900, 050999, 069903
Mathematical Sciences	090401 –090499	010100 - 010199
Physical Sciences	090501 – 090599, 010204	010300 - 010799
Information Technology	090201 - 090299	020100 - 029999

Science and Information Technology Subjects

As already noted, the pre-2001 classifications of subjects into Discipline Groups has been replaced by the new 'Field of Education' classification, a classification common to courses as well as subjects. As was the situation with courses, the mapping between the old and new classifications is imperfect.

Figure 4 shows old and new top-level classifications for subjects.

Figure 4: Branches of Learning and Fields of Education

Branches of Learning Pre 2001	Broad Fields of Education 2001 +
01 Humanities	01 Natural & Physical Sciences
02 Social studies	02 Information Technology
03 Education	03 Engineering & Related Technologies
04 Sciences	04 Architecture/Building
05 Mathematics, Computing	05 Agriculture/Environmental& Related
06 Visual/Performing Arts	06 Health
07 Engineering, Processing	07 Education
08 Health Sciences	08 Management & Commerce
09Admin, Business, Eco, Law	09 Society & Culture
10 Built Environment	10 Creative Arts
	11 Food/Hospitality/Personal Services
	12 Mixed Field Programs

Source: Pre 2001: DEETYA Higher Education Student Collection Technical Documentation, Appendix E
2001 + : ABS Appendices 10 & 11. Obtained in August 2003 from http://www.abs.gov.au

The new Field of Education classification is a six-digit classification, in contrast with the four-digit Discipline Group classification which it replaced. In theory, therefore, it should be possible to describe subjects to a greater level of detail in future. However, the changes which affect 'Science' subjects provide considerable points of ambiguity in the mapping of old discipline groups to new fields of education. For instance, it was noted that from 2001, COURSES in soil Science were to be added to FoE *01 Natural & Physical Science*, and in this study, this change has been made retrospectively. However, SUBJECTS in soil Science were, until 2001, linked to Discipline Group *1101 Agriculture*. Since many other subjects (not only soil Science subjects) were ALSO linked to Discipline Group *1101 Agriculture*, one cannot therefore redistribute all of student load attributed to *1101 Agriculture* in years 1989 to 1997 to the specific Field of Education 'soil Science'. The over riding assumption which must be made is that universities have always linked subjects to the appropriate discipline group (pre-2001) or field of education (2001 +).

Given that all the potential clash points for the change in classifying subjects are ambiguous, no changes have been made to pre-2001 student load data for this report.

However, there is an important change to note. Files provided by DEST for student load are different from those they supplied for the study undertaken for *Trends.* The methodology used by DEST in 1989, 1993 and 1997 (and therefore the figures produced in *Trends*) were based on the 31 March census date each year. Student load (EFTSU) represented *actual* student load in Semester 1 for students enrolled in Semester 1, plus the *estimated* student load for those students in Semester 2. Since the publication of *Trends*, DEST has re-worked student load data, so the student load figures previously reported no longer apply. Neither DEST's own publications of the time, nor the student load tables in *Trends* match DEST's reconfigured 'official' figures. However, this should not concern us; this study provides 'official' enumerations for all years 1989 to 2002. In order to simplify this issue, Figure 5 provides a reconciliation of those student load figures used in *Trends* and the 'official' figures used in this study:

Figure 5: Reconciliation of reported DEST Student Load Data

	1989	1993	1997
Figures from *Trends*			
Science/Information Technology	78473	100232	109257
All Other	271655	349193	404847
Total	350128	449425	514104
Figures used in this report			
Science/Information Technology	79168	97768	108187
All Other	275067	343317	406540
Total	354235	441085	514727
Variation			
Science/Information Technology	695	-2464	-1070
All Other	3412	-5876	1693
Total	4107	-8340	623

Because of the ambiguities caused by the various changes, subjects have been grouped in a specific way to permit the time series analysis required by this study. These are summarised in Figure 6, and details can be found in Appendix 1.

Figure 6: **Subject Groupings used in Tables in this Study**

Subject Grouping	Discipline Group Codes 1989 - 1997	FoE Codes 2001 +
Behavioural Sciences	0201	090700 - 090799
Biological Sciences	0401	010900 – 010900
Chemical Sciences	0405	010500 – 010599
Earth Sciences	0402	010700 – 010799
Mathematical Sciences	0500, 0501, 0599	010100 – 010199
Other Sciences	0404, 0499	019900 – 019999
Physical/Materials Sciences	0403	010300 – 010303
Information Technology	0502, 0503	020100 - 029999

The material in this section has been a brief introduction to university statistics and is incorporated into a more detailed description in Appendix 1 Higher Education Statistics – How do they Work?

3. University Enrolments 1989 – 2002

This section considers enrolments sector-wide, and the set of tables which follow summarise the major changes. The first year of the Dawkins reforms, 1989, represented the start of the expansion of the sector and marked the introduction of the Higher Education Contribution Scheme (HECS). The Australian higher education population has expanded rapidly since then, particularly in the early 1990s. The Dawkins 'Green Paper' (Dawkins, 1987, p1), had as one of its aims '…to promote further growth in the higher education system in a manner consistent with our economic, social, and cultural needs.' The 'White Paper' which followed (Dawkins, 1988) led to a number of major changes including expansion of the system, and a discussion about new ways of financing this expansion. In 1989, there were just over 441,000 enrolments in all Fields of Study/Education, at all levels of course, but by 2002 there were nearly 751,000.

Enrolments by Level of Course

Table 1 shows that universities had an additional 309,866 students enrolled in 2002 than had been there in 1989, a growth of 70.3%. Bachelor degree enrolments grew the most, by nearly 254,000, or 82%. The expansion of bachelor degree enrolments represented 82% of the actual growth. The proportion of bachelor degree students (which here includes graduate entry bachelors and bachelor (~~Hons.~~Hons) enrolments) has hovered around 75% since the early 1990s. The sector also had an additional 23,844 higher degree by research students, and 56,551 more higher degree by coursework enrolments (masters by coursework, graduate certificates and postgraduate diplomas). Much of the expansion in coursework and 'other postgraduate' enrolments has been in fee-paying courses, by both domestic and overseas students. The decline of 'other undergraduate' numbers, a reflection of the upgrading and re-defining of many sub-degree courses as bachelor courses, should be noted.

Table 1: Enrolments: All Fields of Study/Education 1989 – 2002 by Level of Course

Level of Course						Growth 1989 - 2002	
	1989	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Higher Degree by Research	14751	28344	35144	38397	38595	23844	161.6%
Higher Degree by Coursework	15980	33584	49360	67870	72531	56551	353.9%
Other Postgraduate	35318	47217	53296	48067	50896	15578	44.1%
Bachelor #	309650	434701	496386	542756	563586	253936	82.0%
Other Undergraduate	62954	25802	18865	17802	13330	-49624	-78.8%
Non Award	2421	5968	5798	10207	12002	9581	395.7%
Total	**441074**	**575616**	**658849**	**725099**	**750940**	**309866**	**70.3%**
% Bachelor	70.2%	75.5%	75.3%	74.9%	75.1%	82.0%	

Source: DEST Aggregated Data Sets
Bachelor (Graduate Entry) courses were redefined 'Undergraduate' from 1994. However, in this table, these enrolments have been included as 'Bachelor' for all years.

Enrolments by Sex

Table 2 and Figure 7 demonstrate the continuing trend of gender imbalance in the Australian higher education sector. Female student enrolments have increased in number by 185,632 between 1989 and 2002, a rate of growth over the period of 80.8%. This increase was nearly 60% of the total increase. Sector wide, women now comprise over 55% of total enrolments. Of course, female numerical superiority is neither uniform across the sector, nor across levels of course.

Table 2: **Enrolments: All Fields of Study/Education 1989 - 2002 by Sex**

Sex						Growth 1989 - 2002	
	1989	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Female	229790	307630	358669	399222	415422	185632	80.8%
Male	211284	267986	300180	325877	335518	124234	58.8%
Total	**441074**	**575616**	**658849**	**725099**	**750940**	**309866**	**70.3%**
% Female	52.1%	53.4%	54.4%	55.1%	55.3%	59.9%	

Source: DEST Aggregated Data Sets

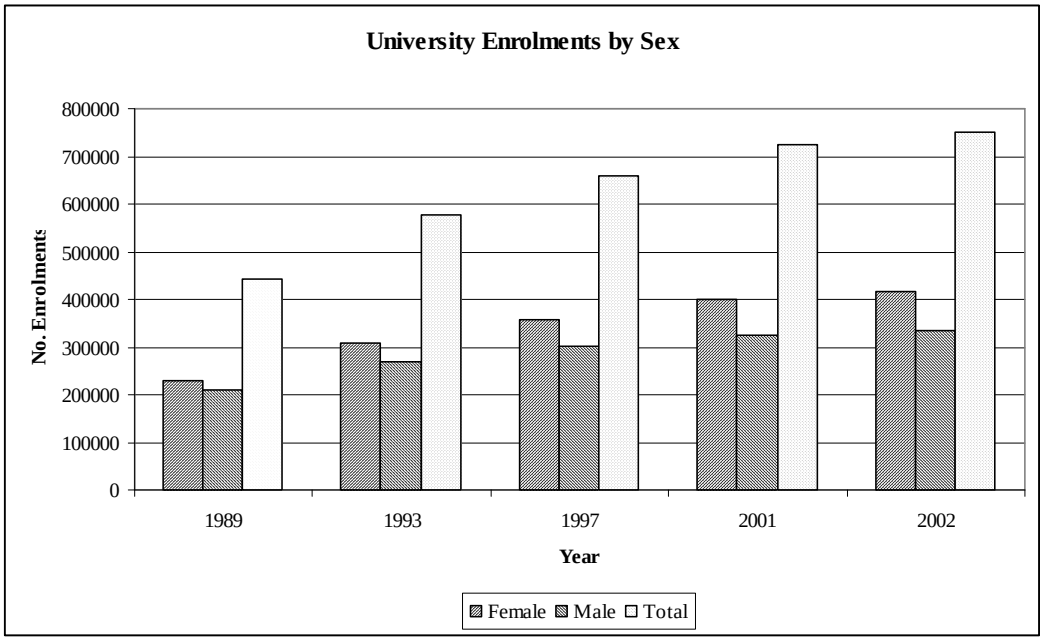

Figure 7 Enrolments by Sex

Enrolments by Enrolment Type

Table 3 shows that most students attend university full time, increasing to 67.7% in 2002, up from 61.7% in 1989. Growth in full time enrolments provided over 76% of total growth. This increase is driven by the numerically dominant cohort of bachelor degree students, the majority of which attend full time, and the rapid expansion in overseas students, a cohort which is usually full time. External enrolments have more than doubled over the period, but there was a slight decline between 2001 and 2002.

Table 3: **Enrolments: All Fields of Study/Education 1989 - 2002 by Enrolment Type**

Enrolment Type						Growth 1989 - 2002	
	1989	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
External	48409	63956	87754	102063	101405	52996	109.5%
Full Time	272100	343579	391454	476717	508054	235954	86.7%
Part Time	120565	168081	179641	146319	141481	20916	17.3%
Total	**441074**	**575616**	**658849**	**725099**	**750940**	**309866**	**70.3%**
% Full Time	61.7%	59.7%	59.4%	65.7%	67.7%	76.1%	
% External	11.0%	11.1%	13.3%	14.1%	13.5%	17.1%	

Source: DEST Aggregated Data Sets

Enrolments by Domestic and Overseas Students

Much of the expansion of university enrolment numbers in recent years has been generated by overseas students, as summarised in Table 4. Enrolments by these students have increased by 103,614 since 1989, and their growth has been one third of total growth. As a proportion of all students, overseas students have increased from 4.8% in 1989 to 16.6% in 2002. Not all overseas students are studying onshore. Many are distance education students, and an increasing number are students studying are at Australian universities' offshore campuses.

Table 4: **Enrolments: All Fields of Study/Education 1989 - 2002 by Domestic & Overseas Students**

Domestic/Overseas						Growth 1989 - 2002	
	1989	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Domestic	419962	538464	595853	613034	626214	206252	49.1%
Overseas	21112	37152	62996	112065	124726	103614	490.8%
Total	**441074**	**575616**	**658849**	**725099**	**750940**	**309866**	**70.3%**
% Overseas	4.8%	6.5%	9.6%	15.5%	16.6%	33.4%	

Source: DEST Aggregated Data Sets

Enrolments by State/Territory

Table 5 shows enrolments by State/Territory. New South Wales and Victoria as the most populous states also have the most university enrolments. New South Wales demonstrated the most absolute growth (+92,321, or 66.2%) and Queensland the highest proportionate growth (79,683 or 120.4%). Victoria's share of all university students has dropped the most over the period, and Queensland's has increased the most.

Table 5: **Enrolments: All Fields of Study/Education 1989 – 2002 by State/Territory of Institution**

State/Territory						Growth 1989 - 2002	
Number	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
ACT	15272	20723	20020	19935	21014	5742	37.6%
Multi-State*		8462	9372	9782	10766	10766	
New South Wales	139365	174327	204524	230630	231686	92321	66.2%
Northern Territory	2610	4179	4678	4692	5134	2524	96.7%
Queensland	66187	93955	114641	135679	145870	79683	120.4%
South Australia	36208	44445	48535	50868	51894	15686	43.3%
Tasmania	9146	12074	12840	13201	14078	4932	53.9%
Victoria	127807	161991	179030	194067	201905	74098	58.0%
Western Australia	44479	55460	65209	66245	68593	24114	54.2%
Total	**441074**	**575616**	**658849**	**725099**	**750940**	**309866**	**70.3%**
Per Cent							
ACT	3.5%	3.6%	3.0%	2.7%	2.8%	1.9%	
Multi-State*	0.0%	1.5%	1.4%	1.3%	1.4%	3.5%	
New South Wales	31.6%	30.3%	31.0%	31.8%	30.9%	29.8%	
Northern Territory	0.6%	0.7%	0.7%	0.6%	0.7%	0.8%	
Queensland	15.0%	16.3%	17.4%	18.7%	19.4%	25.7%	
South Australia	8.2%	7.7%	7.4%	7.0%	6.9%	5.1%	
Tasmania	2.1%	2.1%	1.9%	1.8%	1.9%	1.6%	
Victoria	29.0%	28.1%	27.2%	26.8%	26.9%	23.9%	
Western Australia	10.1%	9.6%	9.9%	9.1%	9.1%	7.8%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

* The institutions which joined to become multi-state Australian Catholic University were still separate entities in 1989. Enrolments for 1989 were distributed between the ACT, NSW, Queensland and Victoria, according to institutional location.

4. Science & Information Technology c.f. with Other Fields of Study/Education

The next set of tables compares change enrolments in Science, Information Technology, and Other Than Science & Information Technology Courses. As noted above, the 'Science' courses as defined in this report include some courses which were not described by DEST as 'Science' in 1989-1997, and some others which were not described by DEST as 'Science' in 2001 and 2002 (See Fig. 2, p5). This point is reiterated, because enrolments shown here for 1989-1997 do not match published figures for Field of Study *09 Science* in those years, nor do figures for 2001-2002 match published figures for Field of Education *01 Natural & Physical Sciences*. An additional note of caution is required in the interpretation of the figures, in terms of the distinction between Science and Information Technology. Although Information Technology enrolments have clearly grown very strongly, it must be remembered that some of our universities have only offered badged Information Technology courses for a few years. Prior to that, students undertaking Information Technology were often enrolled in a generic BSc course, perhaps taking computing subjects as their major studies. This was particularly the case at pre-Dawkins universities. Monash University, for instance, has taught computer Science for many years, but statistics data files for 1989 show zero enrolments, because the students in question were enrolled in a BSc.

Table 6 and Figure 8 summarise student enrolments in all levels of course, identifying separately Science courses, Information Technology courses and Other than Science & Information Technology Courses. Over the period, Science's proportion of all enrolments declined from 11.0% to 8.9%, as Information Technology course enrolments grew from 3.2% to 8.2%. Adding Science and Information Technology together shows an increase from 14.2% in 1989 to 17.1% in 2002. Enrolments in Other than Science & Information Technology Courses also declined as a proportion of all enrolments. There was an absolute decline in Science enrolments between 1997 and 2001, but a recovery between 2001 and 2002 can be noted.

Table 6: Enrolments 1989 – 2002 in Science, Information Technology and all other courses – All Students, All Course Levels

Course Group						Growth 1989 - 2002	
	1989	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Number							
Science Courses	48675	65772	71839	64758	66708	18033	37.0%
Information Technology Courses	13897	21004	27991	56474	61446	47549	342.2%
Science & I/T Courses	62572	86776	99830	121232	128154	65582	104.8%
Other than Science & I/T Courses	378502	488840	559019	603867	622786	244284	64.5%
Total	**441074**	**575616**	**658849**	**725099**	**750940**	**309866**	**70.3%**
Per Cent							
Science Courses	11.0%	11.4%	10.9%	8.9%	8.9%	5.8%	
Information Technology Courses	3.2%	3.6%	4.2%	7.8%	8.2%	15.3%	
Science & I/T Courses	14.2%	15.1%	15.2%	16.7%	17.1%	21.2%	
Other than Science & I/T Courses	85.8%	84.9%	84.8%	83.3%	82.9%	78.8%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

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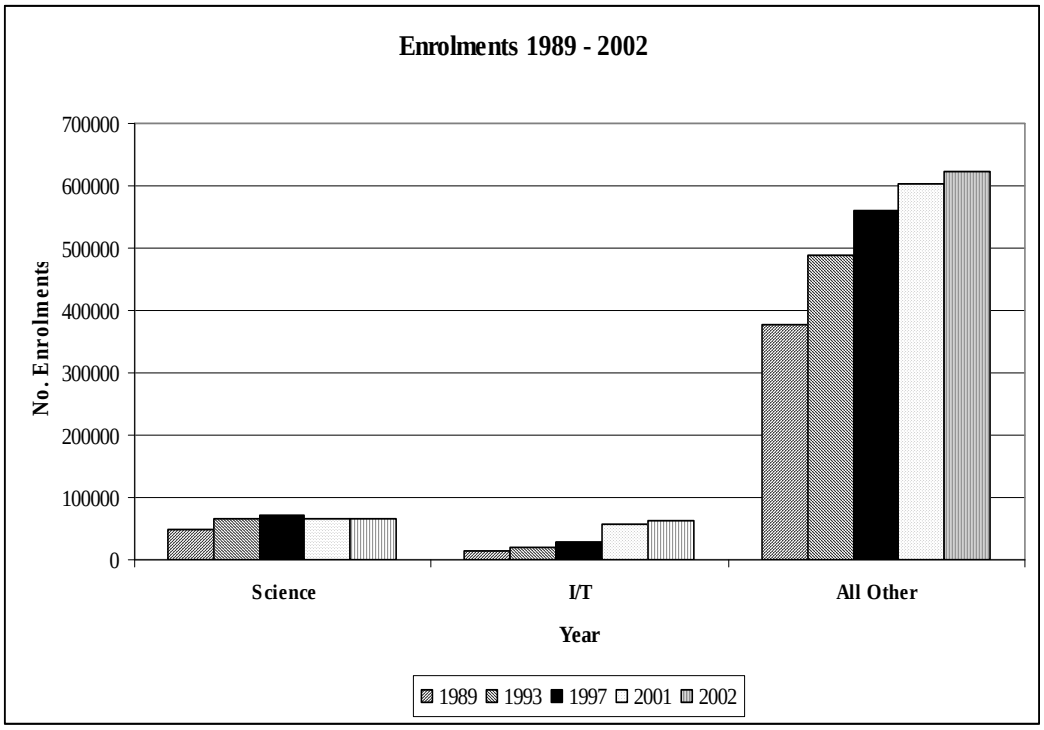

Figure 8: Enrolments by Course Group 1989 - 2002

Table 7 considers the growth pattern between observed years. As can be seen, the strongest growth occurred in the early 1990s, with growth in Science & Information Technology courses increasing by 51.1% between 1989 and 1993, compared to the sector rate of growth of 30.5%. Growth between other observed years was modest by comparison, with Science courses actually losing enrolments between 1997 and 2001. We are all aware of the very strong growth in Information Technology courses, but we cannot be sure how much of the decline in Science courses relates to universities re-badging courses as Information Technology. Total sector growth over the period was 70.3%, averaging just less than 6% per year

Table 7: Growth in Enrolments in Science, Information Technology and All Other Courses – All Students

Course Group	Growth				
	1989-93	**1993-97**	**1997-01**	**2001-02**	**1989-02**
Science Courses	17097	6067	-7081	1950	18033
Per Cent	35.1%	9.2%	-9.9%	3.0%	37.0%
Information Technology Courses	7107	6987	28483	4972	47549
Per Cent	51.1%	33.3%	101.8%	8.8%	342.2%
Science & I/T Courses	24204	13054	21402	6922	65582
Per Cent	38.7%	15.0%	21.4%	5.7%	104.8%
Other than Science & I/T Courses	110338	70179	44848	18919	244284
Per Cent	29.2%	14.4%	8.0%	3.1%	64.5%
Total	**134542**	**83233**	**66250**	**25841**	**309866**
Per Cent	30.5%	14.5%	10.1%	3.6%	70.3%

Source: DEST Aggregated Data Sets

Because bachelor degree enrolments make up the majority of all enrolments (about 75%), the growth and change shown above in Table 1 (p9) is very much dependent on movements in bachelor degree enrolments. The Science share of the bachelor degree pie has declined from 12.9% in 1989 to 9.7% in 2002, but some of this loss of share could be illusory, due to course re-badging. To reiterate, some of the 'Science' courses identified in earlier years could have been populated by students doing computing majors. If Science and Information Technology enrolments are summed, their combined proportion has risen from 15.8% to 17.7%. Bachelor degree growth in Science alone over the period 1989 – 2002 was 37.2%, or if Science and Information Technology are combined, by 103.8%. Growth in courses other than Science or Information Technology have increased in size by 77.9%, more than double the increase in Science course enrolments. These facts are summarised in Table 8.

Table 8: Enrolments 1989 – 2002 in Science, Information Technology and all other courses – Bachelor Degree Students

Course Group						Growth 1989 - 2002	
Number	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Science Courses	39907	52409	57095	53010	54755	14848	37.2%
Information Technology Courses	9036	14955	21340	41090	45009	35973	398.1%
Science & I/T Courses	48943	67364	78435	94100	99764	50821	103.8%
Other than Science & I/T Courses	260707	367337	417951	448656	463822	203115	77.9%
Total	**309650**	**434701**	**496386**	**542756**	**563586**	**253936**	**82.0%**
Per Cent							
Science Courses	12.9%	12.1%	11.5%	9.8%	9.7%	5.8%	
Information Technology Courses	2.9%	3.4%	4.3%	7.6%	8.0%	14.2%	
Science & I/T Courses	15.8%	15.5%	15.8%	17.3%	17.7%	20.0%	
Other than Science & I/T Courses	84.2%	84.5%	84.2%	82.7%	82.3%	80.0%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

After bachelor degree enrolments, the largest proportion of enrolments is in masters by coursework and other non-research postgraduate programs. Growth in these courses has been particularly linked to the expansion of fee-paying courses in areas such as the MBA, and Information Technology masters, graduate certificates and postgraduate diplomas. Science courses have tended to be offered at these levels in only small numbers, but Table 9 (below) demonstrates the growth elsewhere, including in Information Technology.

Table 9: Enrolments 1989 – 2002 in Science, Information Technology and all other courses – Non-Research Postgraduate Students

Course Group						Growth 1989 - 2002	
Number	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Science Courses	2164	4197	4689	3021	3745	1581	73.1%
Information Technology Courses	3108	4172	5119	14056	15050	11942	384.2%
Science & I/T Courses	5272	8369	9808	17077	18795	13523	256.5%
Other than Science & I/T Courses	46026	72432	92848	98860	104632	58606	127.3%
Total	**51298**	**80801**	**102656**	**115937**	**123427**	**72129**	**140.6%**
Per Cent							
Science Courses	4.2%	5.2%	4.6%	2.6%	3.0%	2.2%	
Information Technology Courses	6.1%	5.2%	5.0%	12.1%	12.2%	16.6%	
Science & I/T Courses	10.3%	10.4%	9.6%	14.7%	15.2%	18.7%	
Other than Science & I/T Courses	89.7%	89.6%	90.4%	85.3%	84.8%	81.3%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

Research degree enrolments have always existed in relatively high numbers in Science faculties. Higher degree by research enrolments comprise slightly more than 5% of total enrolments. Table 10 demonstrates that although there has been considerable expansion in Science research degree enrolments, Science's proportion declined from 28.2% in 1989 to 19.7% in 2002. At the research level, it is unlikely that there has been much leakage to Information Technology, so the combination of Science with Information Technology research course enrolments has still produced a loss of share, from 29.8% in 1989 to 22.6% in 2002. As Science faculties always had large numbers of research students, they were coming from a high base, but it seems that expansion of HDR enrolments has been greater in non-Science/Information Technology areas.

Table 10: **Enrolments 1989 - 2002 in Science, Information Technology and all other courses – Higher Degree by Research Students**

Course Group						Growth 1989 - 2002	
Number	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Science Courses	4164	6913	8099	7698	7598	3434	82.5%
Information Technology Courses	236	665	913	981	1108	872	369.5%
Science & I/T Courses	4400	7578	9012	8679	8706	4306	97.9%
Other than Science & I/T Courses	10351	20766	26132	29718	29889	19538	188.8%
Total	**14751**	**28344**	**35144**	**38397**	**38595**	**23844**	**161.6%**
Per Cent							
Science Courses	28.2%	24.4%	23.0%	20.0%	19.7%	14.4%	
Information Technology Courses	1.6%	2.3%	2.6%	2.6%	2.9%	3.7%	
Science & I/T Courses	29.8%	26.7%	25.6%	22.6%	22.6%	18.1%	
Other than Science & I/T Courses	70.2%	73.3%	74.4%	77.4%	77.4%	81.9%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

For completeness, Table 11 summarises numbers and growth of enrolments in all other courses: non-bachelor undergraduate courses. Enrolments in these courses have decreased over time, as institutions replaced sub-degree courses with bachelor degree enrolments.

Table 11: **Enrolments 1989 – 2002 in Science, Information Technology and all other courses – Other Undergraduate and Non-Award Students**

Course Group						Growth 1989 - 2002	
Number	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Science Courses	2440	2253	1979	1032	615	-1825	-74.8%
Information Technology Courses	1517	1212	619	351	306	-1211	-79.8%
Science & I/T Courses	3957	3465	2598	1383	921	-3036	-76.7%
Other than Science & I/T Courses	61418	28305	22438	27441	25519	-35899	-58.5%
Total	**65375**	**31770**	**25036**	**28824**	**26440**	**-38935**	**-59.6%**
Per Cent							
Science Courses	3.7%	7.1%	7.9%	3.6%	2.3%	4.7%	
Information Technology Courses	2.3%	3.8%	2.5%	1.2%	1.2%	3.1%	
Science & I/T Courses	6.1%	10.9%	10.4%	4.8%	3.5%	7.8%	
Other than Science & I/T Courses	93.9%	89.1%	89.6%	95.2%	96.5%	92.2%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

The next three sets of tables consider sex, attendance and citizenship/residency status of students enrolled in Science, Information Technology and other courses.

Table 12 examines numbers and proportions of female and male students. The table reveals that there has been strong growth in enrolments by female students, particularly in Information Technology. However, the proportion of female students in Information Technology courses has not increased over time, and they continue to remain in the minority, filling about one quarter of places. Female students in Science are now in the majority, with the trend since 1989 showing strong growth. The number of women in Information Technology has trebled between 1989 and 2002, but growth has also been strong in Science courses, increasing by only slightly less than the rate in non-Science course areas. Since 1989, the number of women undertaking Science or Information Technology courses increased by over 26,000, including nearly 15,000 in Science. At the same time, only an additional 3,090 male students entered Science, while over 36,000 more went into Information Technology courses.

Male Science students' relative proportion of all male students has declined, from 13.4% in 1989, to 9.3% in 2002. At the same time, the male proportion of Information Technology students to all male students has increased from 4.9% to 13.8%. The growth in the number of male enrolments in Science has been rather low when compared with male enrolments overall.

Table 12: Enrolments 1989 – 2002 in Science, Information Technology and all other courses – Female & Male Students

Course Group						Growth 1989 - 2002	
Number	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Female Students							
Science Courses	20451	30093	35561	33938	35394	14943	73.1%
Information Technology Courses	3644	5425	6369	14376	15034	11390	312.6%
Science & I/T Courses	24095	35518	41930	48314	50428	26333	109.3%
Other than Science & I/T Courses	205695	272112	316739	350908	364994	159299	77.4%
Total	**229790**	**307630**	**358669**	**399222**	**415422**	**185632**	**80.8%**
Per Cent							
Science Courses	8.9%	9.8%	9.9%	8.5%	8.5%	8.0%	
Information Technology Courses	1.6%	1.8%	1.8%	3.6%	3.6%	6.1%	
Science & I/T Courses	10.5%	11.5%	11.7%	12.1%	12.1%	14.2%	
Other than Science & I/T Courses	89.5%	88.5%	88.3%	87.9%	87.9%	85.8%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	
Number							
Male Students							
Science Courses	28224	35679	36278	30820	31314	3090	10.9%
Information Technology Courses	10253	15579	21622	42098	46412	36159	352.7%
Science & I/T Courses	38477	51258	57900	72918	77726	39249	102.0%
Other than Science & I/T Courses	172807	216728	242280	252959	257792	84985	49.2%
Total	**211284**	**267986**	**300180**	**325877**	**335518**	**124234**	**58.8%**
Per Cent							
Science Courses	13.4%	13.3%	12.1%	9.5%	9.3%	2.5%	
Information Technology Courses	4.9%	5.8%	7.2%	12.9%	13.8%	29.1%	
Science & I/T Courses	18.2%	19.1%	19.3%	22.4%	23.2%	31.6%	
Other than Science & I/T Courses	81.8%	80.9%	80.7%	77.6%	76.8%	68.4%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

Table 13 examines variations in enrolment type. In the scheme of things, growth in enrolments by external students in Science courses has been modest, and in size have been

outstripped by external student enrolments in Information Technology. Full time enrolments in Science courses have also increased, but at a rate considerably lower than growth overall. Science's proportion has dropped to 10.4% in 2002 from 13.4% in 1989, and the overall number has been almost static since 1997. So far as part time student enrolments are concerned, although there had been numerical growth through the mid 1990s, fewer part time enrolments are now in evidence. The 2002 result shows about the same number of students as there were in 1989, but of course, the sector was rather larger in 2002 than in 1989. Part time growth has been fairly limited throughout the sector.

Table 13: Enrolments 1989 – 2002 in Science, Information Technology and all other courses – External, Full Time & Part Time Students

Course Group						Growth 1989 - 2002	
Number	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
External Students							
Science Courses	2688	3998	4679	4328	4592	1904	70.8%
Information Technology Courses	1307	2218	3525	5861	6672	5365	410.5%
Science & I/T Courses	3995	6216	8204	10189	11264	7269	182.0%
Other than Science & I/T Courses	44414	57740	79550	91874	90141	45727	103.0%
Total	**48409**	**63956**	**87754**	**102063**	**101405**	**52996**	**109.5%**
Per Cent							
Science Courses	5.6%	6.3%	5.3%	4.2%	4.5%	3.6%	
Information Technology Courses	2.7%	3.5%	4.0%	5.7%	6.6%	10.1%	
Science & I/T Courses	8.3%	9.7%	9.3%	10.0%	11.1%	13.7%	
Other than Science & I/T Courses	91.7%	90.3%	90.7%	90.0%	88.9%	86.3%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	
Number							
Full Time Students							
Science Courses	36490	47430	51479	50152	52614	16124	44.2%
Information Technology Courses	7333	11160	15619	39324	43913	36580	498.8%
Science & I/T Courses	43823	58590	67098	89476	96527	52704	120.3%
Other than Science & I/T Courses	228277	284989	324356	387241	411527	183250	80.3%
Total	**272100**	**343579**	**391454**	**476717**	**508054**	**235954**	**86.7%**
Per Cent							
Science Courses	13.4%	13.8%	13.2%	10.5%	10.4%	6.8%	
Information Technology Courses	2.7%	3.2%	4.0%	8.2%	8.6%	15.5%	
Science & I/T Courses	16.1%	17.1%	17.1%	18.8%	19.0%	22.3%	
Other than Science & I/T Courses	83.9%	82.9%	82.9%	81.2%	81.0%	77.7%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	
Number							
Part Time Students							
Science Courses	9497	14344	15681	10278	9502	5	0.1%
Information Technology Courses	5257	7626	8847	11289	10861	5604	106.6%
Science & I/T Courses	14754	21970	24528	21567	20363	5609	38.0%
Other than Science & I/T Courses	105811	146111	155113	124752	121118	15307	14.5%
Total	**120565**	**168081**	**179641**	**146319**	**141481**	**20916**	**17.3%**
Per Cent							
Science Courses	7.9%	8.5%	8.7%	7.0%	6.7%	0.0%	
Information Technology Courses	4.4%	4.5%	4.9%	7.7%	7.7%	26.8%	
Science & I/T Courses	12.2%	13.1%	13.7%	14.7%	14.4%	26.8%	
Other than Science & I/T Courses	87.8%	86.9%	86.3%	85.3%	85.6%	73.2%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

Table 14 and Figure 9 look at enrolments by domestic and overseas students. The rate of growth among domestic Science students was well below the sector overall figure at 32.7% between 1989 and 2002. This growth figure is an average, and hides the fact that in 2002 there were fewer domestic Science students than there had been in 1993 and 1997. Despite the growth in Science enrolments until 1997, the late 1990s have seen a decline in enrolments. So far as overseas students are concerned, the growth rate of overseas students in Science appears rather strong at 107.8%, but this figure must be compared with the sector-wide expansion of 490.8%.

Table 14: Enrolments 1989 – 2002 in Science, I/T and all other courses – Domestic & Overseas Students

Course Group						Growth 1989 - 2002	
Number	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Domestic Students							
Science Courses	45870	62207	68121	59755	60891	15021	32.7%
Information Technology Courses	12915	18183	23611	37377	37944	25029	193.8%
Science & I/T Courses	58785	80390	91732	97132	98835	40050	68.1%
Other than Science & I/T Courses	361177	458074	504121	515902	527379	166202	46.0%
Total	**419962**	**538464**	**595853**	**613034**	**626214**	**206252**	**49.1%**
Per Cent							
Science Courses	10.9%	11.6%	11.4%	9.7%	9.7%	7.3%	
Information Technology Courses	3.1%	3.4%	4.0%	6.1%	6.1%	12.1%	
Science & I/T Courses	14.0%	14.9%	15.4%	15.8%	15.8%	19.4%	
Other than Science & I/T Courses	86.0%	85.1%	84.6%	84.2%	84.2%	80.6%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	
Number							
Overseas Students							
Science Courses	2805	3565	3718	5003	5817	3012	107.4%
Information Technology Courses	982	2821	4380	19097	23502	22520	2293.3%
Science & I/T Courses	3787	6386	8098	24100	29319	25532	674.2%
Other than Science & I/T Courses	17325	30766	54898	87965	95407	78082	450.7%
Total	**21112**	**37152**	**62996**	**112065**	**124726**	**103614**	**490.8%**
Per Cent							
Science Courses	13.3%	9.6%	5.9%	4.5%	4.7%	2.9%	
Information Technology Courses	4.7%	7.6%	7.0%	17.0%	18.8%	21.7%	
Science & I/T Courses	17.9%	17.2%	12.9%	21.5%	23.5%	24.6%	
Other than Science & I/T Courses	82.1%	82.8%	87.1%	78.5%	76.5%	75.4%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

As identified above, overseas students now number about 125,000, some 16.6% of the sector's enrolments. The rate of growth in these enrolments has been large, particularly in Information Technology. In 1989, there were 982 Information Technology enrolments by overseas students; there are now 23,502, an increase of 22,520, or 2,293.3%. Information Technology is popular with overseas students, with the proportion having risen to 18.8% of all overseas student enrolments by 2002. From the table, it can be calculated that overseas students constituted 38.2% of all enrolments in Information Technology courses in 2002, up from 7.1% in 1989. This trend could change if the reported reduced demand for Information Technology courses in 2003 continues into the future. Immigration regulations have been changed partly because of the poor state of the Information Technology labour market and partly because of concern about the standards of masters by course work degrees of only 18 months duration.

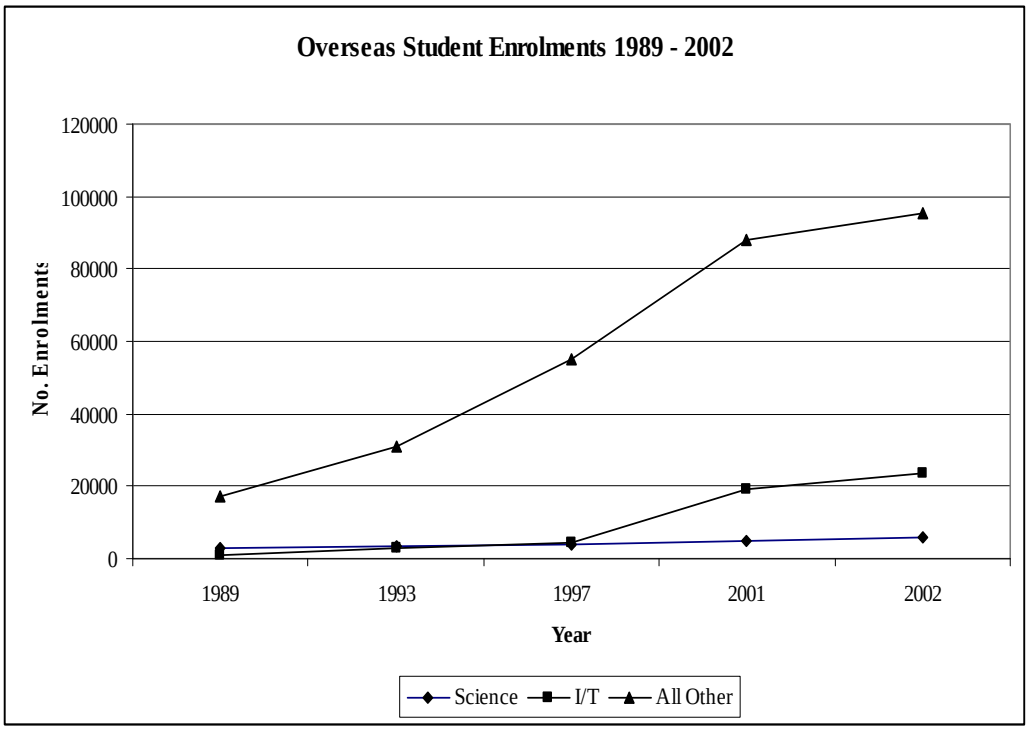

Figure 9 Overseas Student Enrolments by Course Grouping

The next two tables examine students according to their liability for, or exemption from payments for the Higher Education Contribution Scheme (HECS). Table 15 shows the numbers and distribution of HECS-liable students. It can be seen that Science students have a greater than average proportion of HECS-liable students. The proportion of Science students deferring their HECS liability was 81.8% in 1989, falling slightly to 79.5% in 2002. This is perhaps an indication of Science's higher than average proportion of undergraduate bachelor students (a comparison of Tables 6 and 8 shows that in 2002, bachelor degree enrolments comprised 75% of all enrolments, compared with 82% in Science). Students in Information Technology courses were less likely than Science students to defer HECS in 1989 (72.4% deferred HECS), but the proportion had risen to 78.3% by 2002. Rates of HECS deferral were lower by students in Other Than Science and Information Technology courses than for Science students throughout the period.

Table 15: Enrolments 1989 – 2002 in Science, I/T and all other courses – Enrolments by HECS Liability Status: HECS Liable

HECS Liable Students						Growth 198 9 -2002	
Number	**1989**	**1993**	**1997**	**2001**	**2002**	**No**	**%**
Science							
Deferred HECS	34224	43854	45287	40624	41200	6976	20.4%
Paid Up-front	7594	11528	14085	10345	10635	3041	40.0%
HECS Liable Sub total	41818	55382	59372	50969	51835	10017	24.0%
% HECS Deferred	**81.8%**	**79.2%**	**76.3%**	**79.7%**	**79.5%**		
Information Technology							
Deferred HECS	9011	12208	15059	23207	23551	14540	161.4%
Paid Up-front	3442	4751	6007	6466	6542	3100	90.1%
HECS Liable	12453	16959	21066	29673	30093	17640	141.7%
% HECS Deferred	**72.4%**	**72.0%**	**71.5%**	**78.2%**	**78.3%**		
Other Than Science & I/T							
Deferred HECS	245388	287879	310276	318826	324852	79464	32.4%
Paid Up-front	76849	104409	128003	101890	102610	25761	33.5%
HECS Liable	322237	392288	438279	420716	427462	105225	32.7%
% HECS Deferred	**76.2%**	**73.4%**	**70.8%**	**75.8%**	**76.0%**		
All Course Groups							
Deferred HECS	288623	343941	370622	382657	389603	100980	35.0%
Paid Up-front	87885	120688	148095	118701	119787	31902	36.3%
HECS Liable	376508	464629	518717	501358	509390	132882	35.3%
% HECS Deferred	**76.7%**	**74.0%**	**71.4%**	**76.3%**	**76.5%**		

Source: DEST Aggregated Data Sets

Table 16 looks at students who are exempt from HECS. Some of the schemes are relatively new, such as PELS (the Postgraduate Education Loans Scheme) and domestic undergraduate fees, but in the case of the latter, it can be seen that few domestic Science undergraduates are paying full fees. In the case of domestic HECS exempt students, the Science number is quite large, a reflection of Science's high presence in higher degrees by research. Most PhD students, and many masters by research students hold HECS Exemption Scholarships.

Among overseas fee paying students, the Science presence is quite low, especially when compared with the situation with Information Technology, which has been an overseas fee-paying student magnet.

Table 16: Enrolments 1989 – 2002 in Science, I/T and all other courses – Enrolments by HECS Liability Status – HECS Exempt

HECS Exempt Students						Growth 1989 - 2002	
	1989	**1993**	**1997**	**2001**	**2002**	**No**	**%**
Domestic Fee paying							
Science							
Postgraduate Education Loans Scheme (PELS)					572	572	
Domestic fee-paying Undergraduate				199	293	293	
Domestic fee-paying Postgraduate	61	287	947	1434	1466	1405	
Sub Total Domestic Fee paying	61	287	947	1633	2331	2270	
Information Technology							
PELS					1971	1971	
Domestic fee-paying Undergraduate				222	399	399	
Domestic fee-paying Postgraduate	105	585	1674	6239	4129	4024	
Sub Total Domestic Fee paying	105	585	1674	6461	6499	6394	
Other Than Science & I/T							
PELS					12808	12808	
Domestic fee-paying Undergraduate				4220	5054	5054	
Domestic fee-paying Postgraduate	4523	13957	29668	50180	41179	36656	
Sub Total Domestic Fee paying	4523	13957	29668	54400	59041	54518	
All Course Groups							
PELS					15351	15351	
Domestic fee-paying Undergraduate				4641	5746	5746	
Domestic fee-paying Postgraduate	4689	14829	32289	57853	46774	42085	
Sub Total Domestic Fee paying	4689	14829	32289	62494	67871	63182	
Domestic HECS Exempt							
Science	4073	6605	7875	7231	6736	2663	65.4%
Information Technology	378	666	870	1243	1353	975	257.9%
Other Than Science & I/T	35041	52311	36730	41292	41808	6767	19.3%
Sub total Other Domestic HECS Exempt	39492	59582	45475	49766	49897	10405	26.3%
Overseas Fee-paying							
Science	2723	3498	3645	4925	5806	3083	113.2%
Information Technology	961	2794	4381	19097	23501	22540	2345.5%
Other Than Science & I/T	16701	30284	54342	87459	94475	77774	465.7%
Sub total Overseas	20385	36576	62368	111481	123782	103397	507.2%
Total	**48675**	**65772**	**71839**	**64758**	**66708**	**18033**	**37.0%**

Source: DEST Aggregated Data Sets

The majority of students in Australian higher education are enrolled in bachelor (pass) degrees. Table 17 considers the basis of admission of students to these courses, and in particular looks at school leavers as a source of students. The proportion of Science students starting university as direct school leavers is higher than for either Information Technology students or those enrolled in Other Than Science/Information Technology courses. Given the somewhat muted demand for Science courses, the growth in this category has been very low for Science, rising only 10.5% between 1989 and 2002. As a proportion of all bases of admission, school leavers have declined from 71.9% in 1989, to 66.1% in 2002. In Information Technology, school leavers have both represented a much lower proportion of the intake, and have declined over the period from 60.2% to 44.9%.

Table 17: Enrolments 1989 – 2002 in Science, I/T and all other courses – Bachelor (Pass) Students by Basis of Admission

Basis of Admission						Growth 1989 - 2002	
	1989	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Science							
Completed H/Ed Course	539	716	1052	939	908	369	68.5%
Incomplete H/Ed Course	1639	1920	2716	2642	2265	626	38.2%
School Leaver	11157	12045	12970	11835	12328	1171	10.5%
Ex-TAFE	334	379	748	795	830	496	148.5%
Other Bases of Admission	1841	2670	2243	2731	2322	481	26.1%
Total	**15510**	**17730**	**19729**	**18942**	**18653**	**3143**	**20.3%**
% School Leaver	**71.9%**	**67.9%**	**65.7%**	**62.5%**	**66.1%**	**37.3%**	
Information Technology							
Completed H/Ed Course	253	318	987	2322	1935	1682	664.8%
Incomplete H/Ed Course	599	560	1163	2078	1574	975	162.8%
School Leaver	2432	2565	4169	7302	6564	4132	169.9%
Ex-TAFE	139	325	969	1606	1685	1546	1112.2%
Other Bases of Admission	618	1773	1389	3954	2853	2235	361.7%
Total	**4041**	**5541**	**8677**	**17262**	**14611**	**10570**	**261.6%**
% School Leaver	**60.2%**	**46.3%**	**48.0%**	**42.3%**	**44.9%**	**39.1%**	
Other Than Science & I/T							
Completed H/Ed Course	9844	12073	12675	12726	10676	832	8.5%
Incomplete H/Ed Course	9527	14620	20821	21505	19060	9533	100.1%
School Leaver	53010	59899	71719	70852	70763	17753	33.5%
Ex-TAFE	2143	4808	11864	11864	12466	10323	481.7%
Other Bases of Admission	19399	27998	29575	37427	31213	11814	60.9%
Total	**93923**	**119398**	**146654**	**154374**	**144178**	**50255**	**53.5%**
% School Leaver	**56.4%**	**50.2%**	**48.9%**	**45.9%**	**49.1%**	**35.3%**	
All Course Groups							
Completed H/Ed Course	10636	13107	14714	15987	13519	2883	27.1%
Incomplete H/Ed Course	11765	17100	24700	26225	22899	11134	94.6%
School Leaver	66599	74509	88858	89989	89655	23056	34.6%
Ex-TAFE	2616	5512	13581	14265	14981	12365	472.7%
Other Bases of Admission	21858	32441	33207	44112	36388	14530	66.5%
Total	**113474**	**142669**	**175060**	**190578**	**177442**	**63968**	**56.4%**
% School Leaver	**58.7%**	**52.2%**	**50.8%**	**47.2%**	**50.5%**	**36.0%**	

Source: DEST Aggregated Data Sets

5. Science and Information Technology: A Close Up

This section provides a closer examination of enrolments of students in defined Science courses.

Table 18 and Figure 10 provide a summary of enrolments in Science and Information Technology courses, by the augmented Science Fields of Study/Education. The groupings shown are based on the Fields of Study/Education classifications, and 'General/Other Science Courses' which include 'general' courses and those in pharmacology, medical technology, medical science, forensic science, food science and biotechnology, and laboratory technology.

Table 18: Enrolments 1989 - 2002 in Science & Information Technology Courses, by Field, All Students

Course Group						Growth 1989 - 2002	
Number	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
General/Other Science Courses	22554	32646	31293	32112	33161	10607	47.0%
Life Sciences	15698	20488	28196	23896	25126	9428	60.1%
Mathematical Sciences	4045	4590	4086	2703	2787	-1258	-31.1%
Physical Sciences	6378	8048	8264	6047	5634	-744	-11.7%
All Science Courses	48675	65772	71839	64758	66708	18033	37.0%
IT Courses	13897	21004	27991	56474	61446	47549	342.2%
Science & I/T	**62572**	**86776**	**99830**	**121232**	**128154**	**65582**	**104.8%**
Per Cent							
General/Other Science Courses	36.0%	37.6%	31.3%	26.5%	25.9%	16.2%	
Life Sciences	25.1%	23.6%	28.2%	19.7%	19.6%	14.4%	
Mathematical Sciences	6.5%	5.3%	4.1%	2.2%	2.2%	-1.9%	
Physical Sciences	10.2%	9.3%	8.3%	5.0%	4.4%	-1.1%	
All Science Courses	77.8%	75.8%	72.0%	53.4%	52.1%	27.5%	
IT Courses	22.2%	24.2%	28.0%	46.6%	47.9%	72.5%	
Science & I/T	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

The figures show a substantial decline has occurred in enrolments in the Mathematical and Physical Sciences, and demonstrate that the strongest growth occurred in General/Other courses, and in courses in the Life Sciences. It should be noted that enrolments peaked some time in the late 1990s (with 1997 representing the pinnacle in the tables), and that enrolment numbers have returned to something like what they were 10 years ago. The figures suggest that there has been some recovery between 2001 and 2002.

Information Technology numbers, on the other hand, increased considerably at most levels.

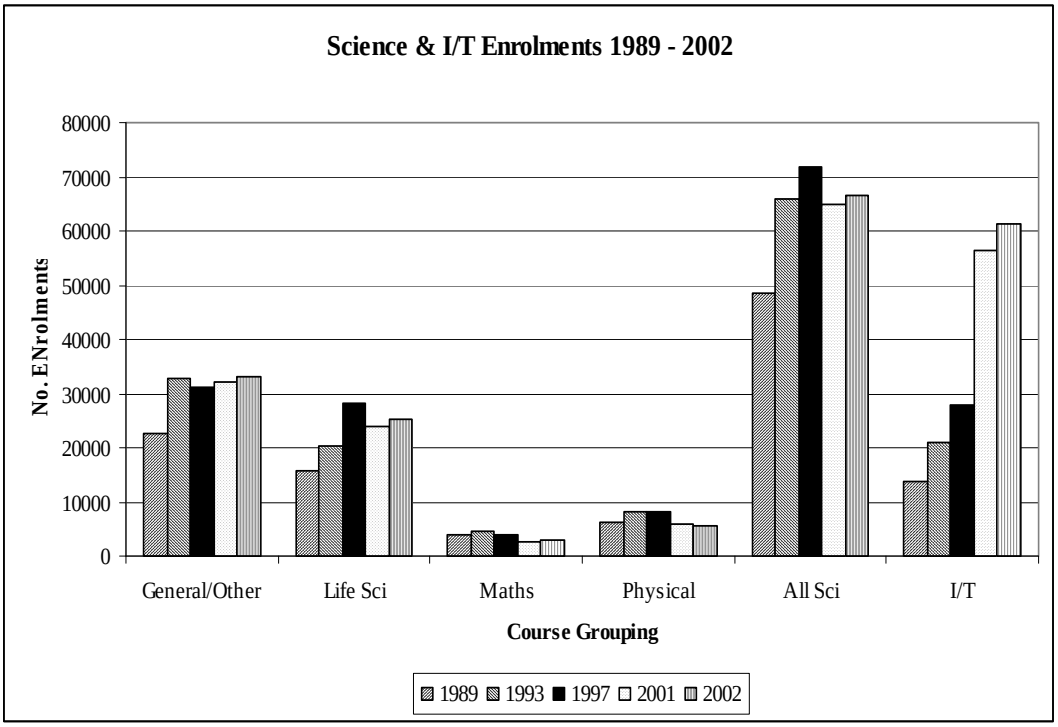

Figure 10 Science and Information Technology Enrolments by Course Group

As observed earlier, because bachelor degree enrolments comprise a major portion of all students, overall patterns of change are derived mainly from what occurs at the bachelor level. In Table 19, which looks at bachelor (pass) enrolments, it can be seen that the declines in Mathematical and Physical Sciences have in fact influenced the overall pattern. Extraordinary growth in Information Technology course bachelor (pass) enrolments can be seen.

Table 19: Enrolments 1989 - 2002 in Science & Information Technology Courses, by Field, Level of Course: Bachelor (Pass)

Course Group						Growth 1989 - 2002	
Number	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Bachelor (Pass)							
General/Other	19563	26924	24923	28253	29163	9600	49.1%
Life Sciences	11345	14596	20754	17041	18232	6887	60.7%
Mathematical Sciences	3227	3418	2993	1808	1780	-1447	-44.8%
Physical Sciences	4117	4843	4860	2429	2418	-1699	-41.3%
All Science	38252	49781	53530	49531	51593	13341	34.9%
Information Technology	8970	14665	21027	40662	44455	35485	395.6%
Science & I/T	**47222**	**64446**	**74557**	**90193**	**96048**	**48826**	**103.4%**
Per Cent							
General/Other	41.4%	41.8%	33.4%	31.3%	30.4%		
Life Sciences	24.0%	22.6%	27.8%	18.9%	19.0%		
Mathematical Sciences	6.8%	5.3%	4.0%	2.0%	1.9%		
Physical Sciences	8.7%	7.5%	6.5%	2.7%	2.5%		
All Science	81.0%	77.2%	71.8%	54.9%	53.7%		
Information Technology	19.0%	22.8%	28.2%	45.1%	46.3%		
Science & I/T	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**		

Source: DEST Aggregated Data Sets

At the bachelor (Hons) level, all areas of Science had increased enrolment numbers, even if at modest levels in Mathematics in particular, but also in Physical Sciences. Honours enrolments in 2002 were 244 fewer than they had been in 1997. Table 20 summarises the situation.

Table 20: Enrolments 1989 - 2002 in Science & Information Technology Courses, by Course Group, Level of Course: Bachelor (Hons)

Course Group						Growth 1989 - 2002	
Number	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
General/Other	970	1538	1625	1738	1569	599	61.8%
Life Sciences	410	758	1278	1311	1202	792	193.2%
Mathematical Sciences	59	111	165	97	86	27	45.8%
Physical Sciences	139	217	452	235	225	86	61.9%
All Science	1578	2624	3520	3381	3082	1504	95.3%
Information Technology	66	290	292	355	486	420	636.4%
Science & I/T	**1644**	**2914**	**3812**	**3736**	**3568**	**1924**	**117.0%**
Per Cent							
General/Other	59.0%	52.8%	42.6%	46.5%	44.0%	31.1%	
Life Sciences	24.9%	26.0%	33.5%	35.1%	33.7%	41.2%	
Mathematical Sciences	3.6%	3.8%	4.3%	2.6%	2.4%	1.4%	
Physical Sciences	8.5%	7.4%	11.9%	6.3%	6.3%	4.5%	
All Science	96.0%	90.0%	92.3%	90.5%	86.4%	78.2%	
Information Technology	4.0%	10.0%	7.7%	9.5%	13.6%	21.8%	
Science & I/T	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

Table 21 looks at the relative importance of ~~Hons.~~ honours enrolments within Science and Information Technology course groups. ~~Hons.~~Honours enrolments are an important feeder source to subsequent enrolments in higher degrees by research. The proportion of ~~Hons.~~ honours enrolments to all undergraduate bachelor enrolments has increased since 1989 in all course groups except Mathematical Sciences, but in General/Other courses there has been a decline since the early 1990s. ~~Hons.~~ Honours would not seem to interest Information Technology students as much as Science students.

Table 21: Enrolments 1989 - 2002 in Science & Information Technology Courses, by Course Group, Level of Course: Bachelor (Hons) as a proportion of all Bachelor Enrolments

Course Group	1989	1993	1997	2001	2002
General/Other	4.7%	5.4%	6.1%	5.8%	5.1%
Life Sciences	3.5%	4.9%	5.8%	7.1%	6.2%
Mathematical Sciences	1.8%	3.1%	5.2%	5.1%	4.6%
Physical Sciences	3.3%	4.3%	8.5%	8.8%	8.5%
All Science	4.0%	5.0%	6.2%	6.4%	5.6%
Information Technology	0.7%	1.9%	1.4%	0.9%	1.1%
Science & I/T	**3.4%**	**4.3%**	**4.9%**	**4.0%**	**3.6%**

Source: DEST Aggregated Data Sets

Higher Degrees by Research include Higher Doctorates by Research, PhDs and Masters by Research enrolments. Here there is a slightly different pattern. The figures show that 1997 represented the high point in Science and Information Technology research enrolments, when over 9,000 students were enrolled. Within the sciences, the largest number of research enrolments have always been in the Life Sciences. In research, even Mathematical and Physical sciences have shown strong growth, in contrast with the situation for bachelor degree

enrolments. Information Technology research enrolments have also risen strongly. The apparent strong growth for Science and Information Technology Higher Degree by Research enrolments of 97.9% must be compared with the figures shown above in Table 10, where Other than Science/Information Technology enrolments at this level had grown by 188.8%.

Table 22: Enrolments 1989 - 2002 in Science & Information Technology Courses, by Field, Level of Course: Higher Degree by Research

Course Group						Growth 1989 - 2002	
Number	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
General/Other	862	1919	2342	939	1190	328	38.1%
Life Sciences	1747	2454	3044	3924	3658	1911	109.4%
Mathematical Sciences	233	509	516	439	431	198	85.0%
Physical Sciences	1322	2031	2197	2396	2319	997	75.4%
All Science	4164	6913	8099	7698	7598	3434	82.5%
Information Technology	236	665	913	981	1108	872	369.5%
Science & I/T	**4400**	**7578**	**9012**	**8679**	**8706**	**4306**	**97.9%**
Per Cent							
General/Other	19.6%	25.3%	26.0%	10.8%	13.7%	7.6%	
Life Sciences	39.7%	32.4%	33.8%	45.2%	42.0%	44.4%	
Mathematical Sciences	5.3%	6.7%	5.7%	5.1%	5.0%	4.6%	
Physical Sciences	30.0%	26.8%	24.4%	27.6%	26.6%	23.2%	
All Science	94.6%	91.2%	89.9%	88.7%	87.3%	79.7%	
Information Technology	5.4%	8.8%	10.1%	11.3%	12.7%	20.3%	
Science & I/T	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

The next two tables examine enrolments according to two binary populations: Male/ Female student enrolments and Domestic/Overseas student enrolments, according to the Field of Study/Education to which their course has been classified.

Table 23 enumerates Science and Information Technology enrolments by sex. Science was one of the Fields of Study designated as 'non-traditional' for women, and female student enrolments were in the minority until 1997. Given that the figures produced show Information Technology courses separate from Science courses, it can be seen that even in 1989, female enrolments exceeded the 40% benchmark stipulated by equity policy. In 2002, female students comprised 53.1% of all Science students, and their numbers had swelled by 73.1% since 1989. Enrolments by male students, on the other hand, increased by only 10.9%. Of the numerical growth in Science enrolments between 1989 and 2002, 82.9% was growth in numbers of women. However, it should again be stressed that Science enrolments have contracted since the mid 1990s, even if there has been some recovery between 2001 and 2002.

In Information Technology, the gender pattern is somewhat different. The proportion of enrolments by female Information Technology students has remained stable, oscillating between 23% and 26%. Even though there are now many more women in Information Technology than had been the case in earlier years, the increase in their number represented only 24% of the total growth between 1989 and 2002. Information Technology remains the only area, apart from Engineering, in which there is a serious numerical imbalance in favour of male students.

Table 23: Enrolments 1989 - 2002 in Science & Information Technology Courses, by Field: Sex

Course Group						Growth 1998 - 2002	
	1989	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
General/Other							
Female	9828	15381	15991	17748	18332	8504	86.5%
Male	12726	17265	15302	14364	14829	2103	16.5%
% Female	**43.6%**	**47.1%**	**51.1%**	**55.3%**	**55.3%**	**80.2%**	
Life Sciences							
Female	7769	10885	15463	13271	14098	6329	81.5%
Male	7929	9603	12733	10625	11028	3099	39.1%
% Female	**49.5%**	**53.1%**	**54.8%**	**55.5%**	**56.1%**	**67.1%**	
Mathematical Sciences							
Female	1299	1530	1457	957	1022	-277	-21.3%
Male	2746	3060	2629	1746	1765	-981	-35.7%
% Female	**32.1%**	**33.3%**	**35.7%**	**35.4%**	**36.7%**	**22.0%**	
Physical Sciences							
Female	1555	2297	2650	1962	1942	387	24.9%
Male	4823	5751	5614	4085	3692	-1131	-23.5%
% Female	**24.4%**	**28.5%**	**32.1%**	**32.4%**	**34.5%**	**-52.0%**	
All Science							
Female	20451	30093	35561	33938	35394	14943	73.1%
Male	28224	35679	36278	30820	31314	3090	10.9%
% Female	**42.0%**	**45.8%**	**49.5%**	**52.4%**	**53.1%**	**82.9%**	
Information Technology							
Female	3644	5425	6369	14376	15034	11390	312.6%
Male	10253	15579	21622	42098	46412	36159	352.7%
% Female	**26.2%**	**25.8%**	**22.8%**	**25.5%**	**24.5%**	**24.0%**	
Science & I/T							
Female	24095	35518	41930	48314	50428	26333	109.3%
Male	38477	51258	57900	72918	77726	39249	102.0%
% Female	**38.5%**	**40.9%**	**42.0%**	**39.9%**	**39.3%**	**40.2%**	

Source: DEST Aggregated Data Sets

Table 24 considers enrolments within Science and Information Technology by domestic and overseas students. In all course groupings, the proportion of overseas students has increased. Whereas overseas enrolments comprised 8.7% of Science enrolments in 2002 (up from 5.8% in 1989, and slightly less in the mid 1990s), in Information Technology enrolments by overseas students comprised over 38.2% in 2002 (up from 7.1% in 1989). This high proportion is a reflection of the increase of 22,520 (or 2,293%) in Information Technology enrolments between 1989 and 2002.

Table 24: Enrolments 1989 - 2002 in Science & Information Technology Courses, by Field: Domestic & Overseas Students

Course Group						Growth 1989 - 2002	
General/Other	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Domestic	21394	31018	30014	29758	30216	8822	41.2%
Overseas	1160	1628	1279	2354	2945	1785	153.9%
% Overseas	**5.1%**	**5.0%**	**4.1%**	**7.3%**	**8.9%**	**16.8%**	
Life Sciences							
Domestic	14940	19580	26677	22251	23210	8270	55.4%
Overseas	758	908	1519	1645	1916	1158	152.8%
% Overseas	**4.8%**	**4.4%**	**5.4%**	**6.9%**	**7.6%**	**12.3%**	
Mathematical Sciences							
Domestic	3689	4208	3778	2462	2524	-1165	-31.6%
Overseas	356	382	308	241	263	-93	-26.1%
% Overseas	**8.8%**	**8.3%**	**7.5%**	**8.9%**	**9.4%**	**7.4%**	
Physical Sciences							
Domestic	5847	7401	7652	5284	4941	-906	-15.5%
Overseas	531	647	612	763	693	162	30.5%
% Overseas	**8.3%**	**8.0%**	**7.4%**	**12.6%**	**12.3%**	**-21.8%**	
All Science							
Domestic	45870	62207	68121	59755	60891	15021	32.7%
Overseas	2805	3565	3718	5003	5817	3012	107.4%
% Overseas	**5.8%**	**5.4%**	**5.2%**	**7.7%**	**8.7%**	**16.7%**	
Information Technology							
Domestic	12915	18183	23611	37377	37944	25029	193.8%
Overseas	982	2821	4380	19097	23502	22520	2293.3%
% Overseas	**7.1%**	**13.4%**	**15.6%**	**33.8%**	**38.2%**	**47.4%**	
Science & I/T							
Domestic	58785	80390	91732	97132	98835	40050	68.1%
Overseas	3787	6386	8098	24100	29319	25532	674.2%
% Overseas	**6.1%**	**7.4%**	**8.1%**	**19.9%**	**22.9%**	**38.9%**	

Source: DEST Aggregated Data Sets

The Information Technology Bubble

Much has been said about the down turn in the Information Technology labour market. Growth has been strong throughout, but the Tables 25 and 26 suggest that the bubble has burst. Perhaps this was predicted by the drop in the Nasdac index for Information Technology stocks in March 2000.

Commencing enrolments provide the information which will allow us to see what might happen in the future. As can be seen, there have been serious declines (totalling 6,426) at all levels of course between 2001 and 2002. Unfortunately, it will be some time before DEST statistics for 2003 are released, to see if the downward trend has continued. Anecdotal evidence indicates that it has. Many universities have seen bachelor degree cut-off scores for Information Technology courses decline over the past couple of years. Bachelor degrees in Information Technology tend to be of four years' duration, so the 3,269 fewer commencing enrolments in 2002 over 2001 will mean a total enrolment decline (over four years) of up to 13,000.

So far as overseas students are concerned, 2,965 fewer students in any one year suggests a revenue loss of something in the order of A$44 million (assuming an average course fee of A$15,000). It has also been reported that many enrolments in Information Technology

courses by overseas students were linked to immigration policies which permitted Information Technology graduates to make an on-shore application for permanent residence status, on the grounds that professionally trained personnel were in short supply. With this policy for Information Technology having come to an end, there has been a decline in demand for such courses.

Table 25: Commencing Information Technology Enrolments by Level of Course - Domestic & Overseas Students

Level of Course					
Number	**1989**	**1993**	**1997**	**2001**	**2002**
Higher Degree by Research	90	263	264	329	312
Masters by Coursework	112	595	1193	4667	3975
Other Postgraduate	1610	1656	1794	4947	2543
Bachelor	4065	5632	8782	17434	14165
Other Undergraduate	793	441	207	195	151
Total	**6670**	**8587**	**12240**	**27572**	**21146**
Increase over Previous Year					
Higher Degree by Research		173	1	65	-17
Masters by Coursework		483	598	3474	-692
Other Postgraduate		46	138	3153	-2404
Bachelor		1567	3150	8652	-3269
Other Undergraduate		-352	-234	-12	-44
Total		**1917**	**3653**	**15332**	**-6426**

Source: DEST Aggregated Data Sets

Table 26: Commencing Information Technology Enrolments by Level of Course - Overseas Students

Level of Course					
Number	**1989**	**1993**	**1997**	**2001**	**2002**
Higher Degree by Research	28	46	59	88	61
Masters by Coursework	9	130	491	2986	2534
Other Postgraduate	70	106	233	2214	1270
Bachelor	413	1208	1780	6656	5131
Other Undergraduate	25	11	7	82	65
Total	**545**	**1501**	**2570**	**12026**	**9061**
Increase over Previous Year					
Higher Degree by Research		18	13	29	-27
Masters by Coursework		121	361	2495	-452
Other Postgraduate		36	127	1981	-944
Bachelor		795	572	4876	-1525
Other Undergraduate		-14	-4	75	-17
Total		**956**	**1069**	**9456**	**-2965**

Source: DEST Aggregated Data Sets

6. Course Completions

This section examines the number of graduates from Australian universities. It should be noted that course completions are reported by universities in the year following the course completion. Table 27 and Figure 11 consider completions at all course levels. Australia produced 90,062 graduates in 1989, at all levels, in all fields, including 9,957 in Science and a further 2,127 in Information Technology. By 2001, there were 182,369 course completions overall, with 15,014 in Science. By this stage, the sector is producing almost as many graduates in Information Technology as in Science. Taken together, course completions in Science and Information Technology have increased from 13.4% of all course completions, to 16.0%, but Science completions alone comprised only 8.2% of all completions in 2001, down from 11.1% in 1989.

Table 27: Course Completions: 1989 – 2001 - All Course Groups, All Course Levels

Course Group					Growth 1989 - 2001	
Number	**1989**	**1993**	**1997**	**2001**	**No.**	**%**
Science	9957	13525	16002	15014	5057	50.8%
Information Technology	2127	3989	5644	14213	12086	568.2%
Science & I/T	12084	17514	21646	29227	17143	141.9%
Other Than Science & I/T	77978	114310	131276	153142	75164	96.4%
Total	**90062**	**131824**	**152922**	**182369**	**92307**	**102.5%**
Per Cent						
Science	11.1%	10.3%	10.5%	8.2%	5.5%	
Information Technology	2.4%	3.0%	3.7%	7.8%	13.1%	
Science & I/T	13.4%	13.3%	14.2%	16.0%	18.6%	
All Other FOSs/FOEs	86.6%	86.7%	85.8%	84.0%	81.4%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

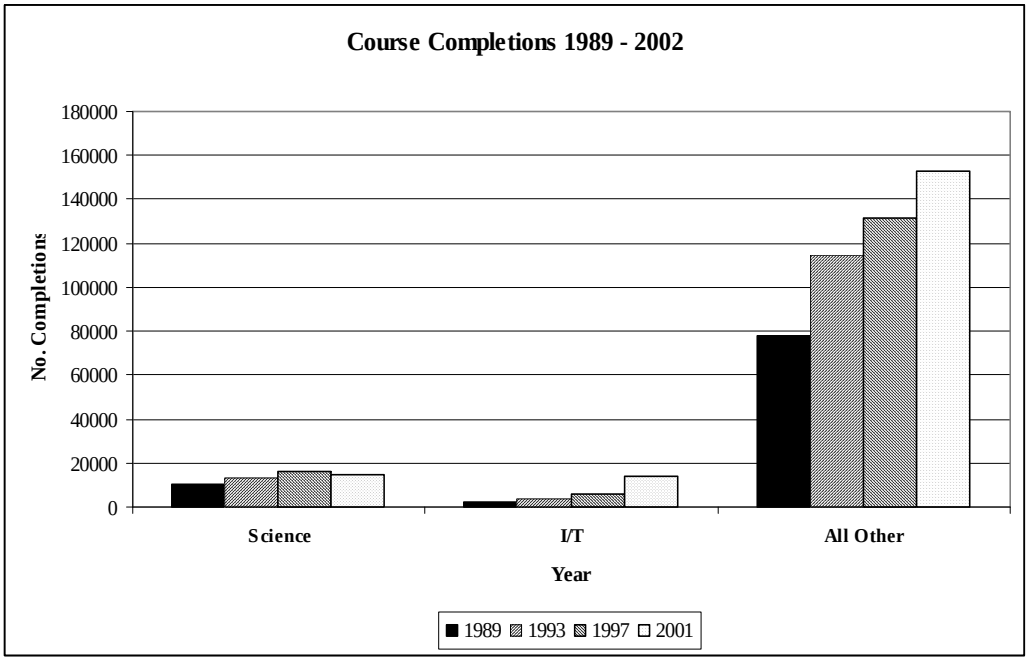

Figure 11 Course Completions 1989 - 2001 by Course Group

Table 28 takes the previous table to a greater level of detail, by broad level of award. The number of higher degree by research graduates greatly increased, from 2,093 in 1989, to 5,480 in 2001. Much of this growth was at the PhD level, which increased in number by 2,667, or 220.6%. The number of masters by research also increased by 748, or 89.7%.

The number of non-research postgraduate degree completions increased, particularly the masters by coursework. Many of these degrees have been in areas such as the MBA. It should be noted that Masters (Prelim.)/ Masters Qualifying 'completions' are not completions of an 'award course', and therefore they should not have been reported at all. Postgraduate diploma numbers have also increased in number, but at a more modest rate than masters by coursework. Part of the reason for this is likely to be degree 'creep', whereby universities redefined some diplomas as a more attractive masters-level qualification, or the 'nested qualifications' situation, where students enrol in a masters program, but can exit after one year with a graduate certificate, or after two years with a postgraduate diploma. A thorough analysis of university regulations over time would be necessary to confirm this suggestion.

The number of bachelor degrees awarded more than doubled. This reflects the expansion in places in the aftermath of the Dawkins reforms of the late 1980s. During the early 1990s recession, the Labor Government opened up enrolment opportunities in part to soak up the then surplus of young people in the labour market. The table also shows that sub-bachelor qualifications have faded, although completions in Associate Degrees first reported in 2001 have increased the number of Other Award Course completions.

Table 28: Course Completions: 1989 – 2001 -All Course Groups, by Course Level

All Course Groups					**Growth 1989 - 2001**	
All Fields	**1989**	**1993**	**1997**	**2001**	**No.**	**%**
Higher Degrees by Research						
Higher Doctorate	50	55	63	22	-28	-56.0%
PhD	1209	1781	3341	3876	2667	220.6%
Masters by Research	834	1359	1771	1582	748	89.7%
Sub Total	**2093**	**3195**	**5175**	**5480**	**3387**	**161.8%**
Other Postgraduate						
Masters by Coursework	3187	8975	17333	29063	25876	811.9%
Masters (Prelim)	1506	927	334	153	-1353	-89.8%
P/G Diploma: (New Area)	9151	10951	13246	12933	3782	41.3%
P/G Diploma: (Extended Skills)	2952	6208	6172	4450	1498	50.7%
Graduate Certificate	732	2196	5152	8929	8197	1119.8%
Doctorate by Coursework			12	77	77	
Sub Total	**17528**	**29257**	**42249**	**55605**	**38077**	**217.2%**
Bachelors						
Bachelor (Graduate Entry)	1522	1648	2535	4088	2566	168.6%
Bachelor (~~Hons.~~Hons)	3577	6674	7598	8545	4968	138.9%
Bachelor (Pass)	50092	83029	91975	103672	53580	107.0%
Sub Total	**55191**	**91351**	**102108**	**116305**	**61114**	**110.7%**
Other Undergraduate						
Associate Degree				408	408	
Diploma	10890	4088	961	1142	-9748	-89.5%
Associate Diploma	4360	3693	1734	2252	-2108	-48.3%
Other Award Course		240	695	1177	1177	
Sub Total	**15250**	**8021**	**3390**	**4979**	**-10271**	**-67.4%**
Total – All Fields	**90062**	**131824**	**152922**	**182369**	**92307**	**102.5%**

Source: DEST Aggregated Data Sets

Looking now at Science award completions in Table 29, it can be seen that the annual number of Science higher degree awards more than doubled between 1989 and 2002, but the growth was less than for the sector overall. However, it must be remembered that Science has always produced a relatively large number of higher degree by research degree graduates, but the growth in the sector overall has been higher, because Science had a high base. In 1989, Science produced about 33% of higher degree by research completions, and 25% in 2001.

Growth in Science 'Other Postgraduate course completions has been more modest. The focus of Science has always been more focussed on research rather than coursework.

At the bachelor degree level, the increase in course completions has been less than half of the rate for the sector overall. In 1989 there were 8,061 bachelor degree completions. This had risen to 11,930 by 2001, an increase of 48%.

Science completions at the sub-degree level show that the 'Science' involvement at this level is very low.

Table 29: Course Completions: 1989 – 2001 - Science Courses Only by Course Level

Science					**Growth 1989 - 2001**	
Higher Degrees by Research	**1989**	**1993**	**1997**	**2001**	**No.**	**%**
Higher Doctorate	5	10	16	9	4	80.0%
PhD	472	604	1043	1119	647	137.1%
Masters by Research	209	262	308	257	48	23.0%
Sub Total	**686**	**876**	**1367**	**1385**	**699**	**101.9%**
Other Postgraduate						
Masters by Coursework	176	401	660	547	371	210.8%
Masters (Prelim)	96	77	31	8	-88	-91.7%
P/G Diploma: (New Area)	239	444	671	241	2	0.8%
P/G Diploma: (Extended Skills)	104	316	305	92	-12	-11.5%
Graduate Certificate		53	73	238	238	
Doctorate by Coursework					0	
Sub Total	**615**	**1291**	**1740**	**1126**	**511**	**83.1%**
Bachelors						
Bachelor (Graduate Entry)	7	5	11	21	14	200.0%
Bachelor (~~Hons.~~Hons)	1310	2150	2492	2440	1130	86.3%
Bachelor (Pass)	6744	8788	9989	9469	2725	40.4%
Sub Total	**8061**	**10943**	**12492**	**11930**	**3869**	**48.0%**
Other Undergraduate						
Associate Degree				19	19	
Diploma	91	59	68	120	29	31.9%
Associate Diploma	504	356	164	43	-461	-91.5%
Other Award Course			171	391	391	
Sub Total	**595**	**415**	**403**	**573**	**-22**	**-3.7%**
Total – Science	**9957**	**13525**	**16002**	**15014**	**5057**	**50.8%**

Source: DEST Aggregated Data Sets

Table 30 looks at course completions in Information Technology. Growth in the number of Information Technology completions has been spectacular, but it has been off a fairly low base. At the research level, 2001 saw 122 more completions than in 1989.

Growth in Information Technology masters by coursework has also been spectacular. There were 25 Information Technology completions in 1989, but 2,902 in 2002. Postgraduate diploma numbers also increased handsomely.

Bachelor course completions have also increased spectacularly, in line with the growth in enrolments. Overall, the number of course completions increased nearly six-fold between 1989 and 2001.

Table 30: Course Completions: 1989 – 2001 - Information Technology Courses Only, by Course Level

Information Technology					Growth 1989 - 2001	
Higher Degrees by Research	**1989**	**1993**	**1997**	**2001**	**No.**	**%**
Higher Doctorate					0	
PhD	12	26	107	98	86	716.7%
Masters by Research	12	46	47	48	36	300.0%
Sub Total	**24**	**72**	**154**	**146**	**122**	**508.3%**
Other Postgraduate						
Masters by Coursework	25	215	685	2902	2877	11508.0%
Masters (Prelim)	14	25	6	18	4	28.6%
P/G Diploma: (New Area)	629	660	626	2088	1459	232.0%
P/G Diploma: (Extended Skills)	162	253	161	779	617	380.9%
Graduate Certificate		56	80	409	409	
Doctorate by Coursework					0	
Sub Total	**830**	**1209**	**1558**	**6196**	**5366**	**646.5%**
Bachelors						
Bachelor (Graduate Entry)				20	20	
Bachelor (~~Hons.~~Hons)	43	184	201	270	227	527.9%
Bachelor (Pass)	957	2314	3596	7436	6479	677.0%
Sub Total	**1000**	**2498**	**3797**	**7726**	**6726**	**672.6%**
Other Undergraduate						
Associate Degree				10	10	
Diploma	4	28	54	32	28	700.0%
Associate Diploma	269	182	70	16	-253	-94.1%
Other Award Course			11	87	87	
Sub Total	**273**	**210**	**135**	**145**	**-128**	**-46.9%**
Total – Information Technology	**2127**	**3989**	**5644**	**14213**	**12086**	**568.2%**

Source: DEST Aggregated Data Sets

Table 31 shows the sum of outcomes for Science and Information Technology. Taken together, course completion increases numbered 17,143, or 141.9%, compared with sector-wide growth of 92,307, or 102.5% (Table 28). Of the growth of over 17,000 for Science and Information Technology, 12,086 was attributable to Information Technology.

Table 31: Course Completions: 1989 – 2001 - Science & Information Technology Courses by Course Level

Science & Information Technology					Growth 1989 - 2001	
Higher Degrees by Research	**1989**	**1993**	**1997**	**2001**	**No.**	**%**
Higher Doctorate						
PhD	484	630	1150	1217	733	151.4%
Masters by Research	221	308	355	305	84	38.0%
Sub Total	**705**	**938**	**1505**	**1522**	**817**	**115.9%**
Other Postgraduate						
Masters by Coursework	201	616	1345	3449	3248	1615.9%
Masters (Prelim)	110	102	37	26	-84	-76.4%
P/G Diploma: (New Area)	868	1104	1297	2329	1461	168.3%
P/G Diploma: (Extended Skills)	266	569	466	871	605	227.4%
Graduate Certificate	0	109	153	647	647	
Doctorate by Coursework	0	0	0	0	0	
Sub Total	**1445**	**2500**	**3298**	**7322**	**5877**	**406.7%**
Bachelors						
Bachelor (Graduate Entry)	7	5	11	41	34	485.7%
Bachelor (~~Hons.~~Hons)	1353	2334	2693	2710	1357	100.3%
Bachelor (Pass)	7701	11102	13585	16905	9204	119.5%
Sub Total	**9061**	**13441**	**16289**	**19656**	**10595**	**116.9%**
Other Undergraduate						
Associate Degree	0	0	0	29	29	
Diploma	95	87	122	152	57	60.0%
Associate Diploma	773	538	234	59	-714	-92.4%
Other Award Course			182	478	478	
Sub Total	**868**	**625**	**538**	**718**	**-150**	**-17.3%**
Total – Science & Information Technology	**12084**	**17514**	**21646**	**29227**	**17143**	**141.9%**

Source: DEST Aggregated Data Sets

Science & Information Technology Course Completions – More Detail

Tables below report on the distribution of course completions by Science and Information Technology students within Science and Information Technology fields. Table 32 shows that course completions in Mathematical Sciences declined by 102 between 1989 and 2002, and that Science completions overall peaked in 1997, with 16,002 completions. The Life Sciences also produced fewer graduates in 2001 than in 1997. The apparent strong growth in completions in Science and Information Technology was driven by the increase in Information Technology.

Table 32: Course Completions: 1989 – 2001 - Science & Information Technology Courses by Course Group

Course Group					Growth 1989 - 2001	
	1989	**1993**	**1997**	**2001**	**No.**	**%**
General/Other	4748	6898	6619	6950	2202	46.4%
Life Sciences	3330	4244	6586	5678	2348	70.5%
Mathematical Sciences	755	936	931	653	-102	-13.5%
Physical Sciences	1124	1447	1866	1733	609	54.2%
All Science	**9957**	**13525**	**16002**	**15014**	**5057**	**50.8%**
Information Technology	2127	3989	5644	14213	12086	568.2%
All Science & I/T	**12084**	**17514**	**21646**	**29227**	**17143**	**141.9%**
General/Other	39.3%	39.4%	30.6%	23.8%		
Life Sciences	27.6%	24.2%	30.4%	19.4%		
Mathematical Sciences	6.2%	5.3%	4.3%	2.2%		
Physical Sciences	9.3%	8.3%	8.6%	5.9%		
All Science	**82.4%**	**77.2%**	**73.9%**	**51.4%**		
Information Technology	17.6%	22.8%	26.1%	48.6%		
Science & I/T	**100.0%**	**100.0%**	**100.0%**	**100.0%**		

Source: DEST Aggregated Data Sets

Table 33 looks at the gender distribution of graduates in the various fields of Science and Information Technology. In Science overall, there were more female graduates, although the number decreased by over 1,000 between the peak in 1997 and 2001. Women's majority was greatest in General/Other Science degrees, and in the Life Sciences, and the bulk of the growth between 1989 and 2001 in these courses was generated by female graduates. It is interesting to note that women have shown little propensity to undertake degrees in the Mathematical Sciences; the decline in that field is due exclusively to the decline in numbers of male graduates.

Physical Sciences and Information Technology are the two fields with relatively few female graduates. The female proportion has increased a little in Physical Sciences, but not so in Information Technology. That said, in 2001 there were 3,261 more female graduates in Information Technology than there had been in 1989. The year 1997 represents the high point in graduate numbers for both men and women in the Physical Sciences.

Table 33: Course Completions: 1989 – 2001 - Science & Information Technology Courses by Course Group and Sex

Course Group					Growth 1989 - 2001	
	1989	**1993**	**1997**	**2001**	**No.**	**%**
General/Other						
Female	2038	3319	3346	3928	1890	92.7%
Male	2710	3579	3273	3022	312	11.5%
Total	**4748**	**6898**	**6619**	**6950**	**2202**	**46.4%**
% Female	**42.9%**	**48.1%**	**50.6%**	**56.5%**	**85.8%**	
Life Sciences						
Female	1619	2266	3652	3240	1621	100.1%
Male	1711	1978	2934	2438	727	42.5%
Total	**3330**	**4244**	**6586**	**5678**	**2348**	**70.5%**
% Female	**48.6%**	**53.4%**	**55.5%**	**57.1%**	**69.0%**	
Mathematical Sciences						
Female	246	344	349	248	2	0.8%
Male	509	592	582	405	-104	-20.4%
Total	**755**	**936**	**931**	**653**	**-102**	**-13.5%**
% Female	**32.6%**	**36.8%**	**37.5%**	**38.0%**		
Physical Sciences						
Female	274	370	576	503	229	83.6%
Male	850	1077	1290	1230	380	44.7%
Total	**1124**	**1447**	**1866**	**1733**	**609**	**54.2%**
% Female	**24.4%**	**25.6%**	**30.9%**	**29.0%**	**37.6%**	
All Science						
Female	4177	6299	7923	7919	3742	89.6%
Male	5780	7226	8079	7095	1315	22.8%
Total	**9957**	**13525**	**16002**	**15014**	**5057**	**50.8%**
% Female	**42.0%**	**46.6%**	**49.5%**	**52.7%**	**74.0%**	
Information Technology						
Female	601	1078	1450	3862	3261	542.6%
Male	1526	2911	4194	10351	8825	578.3%
Total	**2127**	**3989**	**5644**	**14213**	**12086**	**568.2%**
% Female	**28.3%**	**27.0%**	**25.7%**	**27.2%**	**27.0%**	
Science & Information Technology						
Female	4778	7377	9373	11781	7003	146.6%
Male	7306	10137	12273	17446	10140	138.8%
Total	**12084**	**17514**	**21646**	**29227**	**17143**	**141.9%**
% Female	**39.5%**	**42.1%**	**43.3%**	**40.3%**	**40.9%**	

Source: DEST Aggregated Data Sets

Table 34 examines the relative proportions of domestic and overseas graduates in Science and Information Technology. Information Technology has provided the most spectacular growth overall, particularly for Overseas students. Overseas students now represent 45.2% of completions in Information Technology, and growth in their number represents 52.0% of the total growth. The presence of overseas students in other fields is relatively limited: 8.7% of General/Other graduations; 7.9% of completions in the Life Sciences; 13.8% in Mathematical Sciences; and 11.7% in the Physical Sciences. Declines in completion numbers between 1997 and 2001 in all fields except General/Other should be noted. This observation applies to domestic and overseas students alike.

Table 34: Course Completions: 1989 – 2001 - Science & Information Technology Courses by Course Group and Domestic/Overseas Students

Course Group					Growth 1989 - 2001	
	1989	**1993**	**1997**	**2001**	**No.**	**%**
General/Other						
Domestic	4606	6498	6344	6346	1740	37.8%
Overseas	142	400	275	604	462	325.4%
Total	4748	6898	6619	6950	2202	46.4%
% Overseas	**3.0%**	**5.8%**	**4.2%**	**8.7%**	**21.0%**	
Life Sciences						
Domestic	3268	4000	6123	5230	1962	60.0%
Overseas	62	244	463	448	386	622.6%
Total	3330	4244	6586	5678	2348	70.5%
% Overseas	**1.9%**	**5.7%**	**7.0%**	**7.9%**	**16.4%**	
Mathematical Sciences						
Domestic	710	838	831	563	-147	-20.7%
Overseas	45	98	100	90	45	100.0%
Total	755	936	931	653	-102	-13.5%
% Overseas	**6.0%**	**10.5%**	**10.7%**	**13.8%**	**-44.1%**	
Physical Sciences						
Domestic	1075	1304	1638	1531	456	42.4%
Overseas	49	143	228	202	153	312.2%
Total	1124	1447	1866	1733	609	54.2%
% Overseas	**4.4%**	**9.9%**	**12.2%**	**11.7%**	**25.1%**	
All Science						
Domestic	9659	12640	14936	13670	4011	41.5%
Overseas	298	885	1066	1344	1046	351.0%
Total	9957	13525	16002	15014	5057	50.8%
% Overseas	**3.0%**	**6.5%**	**6.7%**	**9.0%**	**20.7%**	
Information Technology						
Domestic	1983	3291	3922	7785	5802	292.6%
Overseas	144	698	1722	6428	6284	4363.9%
Total	2127	3989	5644	14213	12086	568.2%
% Overseas	**6.8%**	**17.5%**	**30.5%**	**45.2%**	**52.0%**	
Science & Information Technology						
Domestic	11642	15931	18858	21455	9813	84.3%
Overseas	442	1583	2788	7772	7330	1658.4%
Total	12084	17514	21646	29227	17143	141.9%
% Overseas	**3.7%**	**9.0%**	**12.9%**	**26.6%**	**42.8%**	

Source: DEST Aggregated Data Sets

The next set of tables looks at course completions by course group within Science and Information Technology, and by level of award. Course completions in higher degrees by research (Table 35) were most common in Life Sciences and Physical Sciences, with these fields providing about 61% of all Science/Information Technology HDR completions in 2001. Information Technology higher degrees by research represent only a small proportion of all completions at this level (9.5% in 2001), but the rate of growth off a small base in 1989 has been strong.

Table 35: Science & Information Technology Course Completions - Higher Degrees by Research

Course Group					Growth 1989 - 2001	
	1989	**1993**	**1997**	**2001**	**No.**	**%**
General/Other	149	188	422	211	62	41.6%
Life Sciences	307	323	487	641	334	108.8%
Mathematical Sciences	39	54	92	92	53	135.9%
Physical Sciences	191	311	366	441	250	130.9%
All Science	**686**	**876**	**1367**	**1385**	**699**	**101.9%**
Information Technology	24	72	154	146	122	508.3%
Science & I/T	**710**	**948**	**1521**	**1531**	**821**	**115.6%**
General/Other	21.0%	19.8%	27.7%	13.8%	7.6%	
Life Sciences	43.2%	34.1%	32.0%	41.9%	40.7%	
Mathematical Sciences	5.5%	5.7%	6.0%	6.0%	6.5%	
Physical Sciences	26.9%	32.8%	24.1%	28.8%	30.5%	
All Science	**96.6%**	**92.4%**	**89.9%**	**90.5%**	**85.1%**	
Information Technology	3.4%	7.6%	10.1%	9.5%	14.9%	
Science & I/T	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100%**	

Source: DEST Aggregated Data Sets

However, patterns of completion in postgraduate by coursework degrees and diplomas are very much biased in favour of Information Technology. Information Technology completions at this level represented 84.6% of all Science/Information Technology completions, as shown in Table 36. Clearly, Mathematical and Physical Science students' interest in coursework is low, with both producing numbers in 2001 at about the same level as in 1989.

Table 36: Science & Information Technology Course Completions - Postgraduate by Coursework

Course Group					Growth 1989 - 2001	
Number	**1989**	**1993**	**1997**	**2001**	**No.**	**%**
General/Other	113	322	453	359	246	217.7%
Life Sciences	277	636	994	541	264	95.3%
Mathematical Sciences	103	151	111	108	5	4.9%
Physical Sciences	122	182	182	118	-4	-3.3%
All Science	**615**	**1291**	**1740**	**1126**	**511**	**83.1%**
Information Technology	830	1209	1558	6196	5366	646.5%
Science & I/T	**1445**	**2500**	**3298**	**7322**	**5877**	**406.7%**
Per Cent						
General/Other	7.8%	12.9%	13.7%	4.9%	4.2%	
Life Sciences	19.2%	25.4%	30.1%	7.4%	4.5%	
Mathematical Sciences	7.1%	6.0%	3.4%	1.5%	0.1%	
Physical Sciences	8.4%	7.3%	5.5%	1.6%	-0.1%	
All Science	**42.6%**	**51.6%**	**52.8%**	**15.4%**	**8.7%**	
Information Technology	57.4%	48.4%	47.2%	84.6%	91.4%	
Science & I/T	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

The distribution of bachelor degree completions is also moving in the direction of Information Technology. Whereas Science bachelor completions increased in number by 3,869 or 48% between 1989 and 2001, in Information Technology the increase was 6,726, or 672.6%. By 2001, the proportion of Information Technology bachelor completions had risen to 39.3% of all bachelor completions in Science and Information Technology.

Table 37: Science & Information Technology Course Completions - Bachelor Degrees

Course Group					Growth 1989 - 2001	
Number	**1989**	**1993**	**1997**	**2001**	**No.**	**%**
General/Other	4336	6175	5635	6230	1894	43.7%
Life Sciences	2400	3158	4972	4482	2082	86.8%
Mathematical Sciences	589	719	723	453	-136	-23.1%
Physical Sciences	736	891	1162	765	29	3.9%
All Science	**8061**	**10943**	**12492**	**11930**	**3869**	**48.0%**
Information Technology	1000	2498	3797	7726	6726	672.6%
Science & I/T	**9061**	**13441**	**16289**	**19656**	**10595**	**116.9%**
Per Cent						
General/Other	47.9%	45.9%	34.6%	31.7%	17.9%	
Life Sciences	26.5%	23.5%	30.5%	22.8%	19.7%	
Mathematical Sciences	6.5%	5.3%	4.4%	2.3%	-1.3%	
Physical Sciences	8.1%	6.6%	7.1%	3.9%	0.3%	
All Science	**89.0%**	**81.4%**	**76.7%**	**60.7%**	**36.5%**	
Information Technology	11.0%	18.6%	23.3%	39.3%	63.5%	
Science & I/T	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

Completion of a Science bachelor (~~Hons.~~Hons) degree is a traditional pathway to enrolment in a higher degree by research. Undertaking an Honours degree in Information Technology is less common, but by 2001, the proportion of Information Technology honours completions had risen from 3.2% to 10%. Most of the numerical growth in Science bachelor (~~Hons.~~Hons) completions occurred in General/Other Science degrees, or in Life Sciences.

Table 38: Science & Information Technology Course Completions - Bachelor (~~Hons.~~Hons)

Course Group					Growth 1989 - 2001	
Number	**1989**	**1993**	**1997**	**2001**	**No.**	**%**
General/Other	797	1286	1268	1139	342	42.9%
Life Sciences	357	612	850	1024	667	186.8%
Mathematical Sciences	47	73	117	65	18	38.3%
Physical Sciences	109	179	257	212	103	94.5%
All Science	**1310**	**2150**	**2492**	**2440**	**1130**	**86.3%**
Information Technology	43	184	201	270	227	527.9%
Science & I/T	**1353**	**2334**	**2693**	**2710**	**1357**	**100.3%**
Per Cent						
General/Other	58.9%	55.1%	47.1%	42.0%	25.2%	
Life Sciences	26.4%	26.2%	31.6%	37.8%	49.2%	
Mathematical Sciences	3.5%	3.1%	4.3%	2.4%	1.3%	
Physical Sciences	8.1%	7.7%	9.5%	7.8%	7.6%	
All Science	**96.8%**	**92.1%**	**92.5%**	**90.0%**	**83.3%**	
Information Technology	3.2%	7.9%	7.5%	10.0%	16.7%	
Science & I/T	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

Table 39 is included for completeness only. Many of the awards at levels below bachelor degree are generally being phased out. The exact cause for the strong growth in Physical Sciences completions at this level cannot be ascertained from the figures used in this study. The figures indicate that Physical Sciences completions now represent 57% of all Science/Information Technology completions at this level.

Table 39: Science & Information Technology Course Completions - Other Undergraduate

					Growth 1989 - 2001	
Number	**1989**	**1993**	**1997**	**2001**	**No.**	**%**
General/Other	150	213	109	150	0	0.0%
Life Sciences	346	127	133	14	-332	-96.0%
Mathematical Sciences	24	12	5		-24	-100.0%
Physical Sciences	75	63	156	409	334	445.3%
All Science	**595**	**415**	**403**	**573**	**-22**	**-3.7%**
Information Technology	273	210	135	145	-128	-46.9%
Science & I/T	**868**	**625**	**538**	**718**	**-150**	**-17.3%**
Per Cent						
General/Other	17.3%	34.1%	20.3%	20.9%		
Life Sciences	39.9%	20.3%	24.7%	1.9%		
Mathematical Sciences	2.8%	1.9%	0.9%	0.0%		
Physical Sciences	8.6%	10.1%	29.0%	57.0%		
All Science	**68.5%**	**66.4%**	**74.9%**	**79.8%**		
Information Technology	31.5%	33.6%	25.1%	20.2%		
Science & I/T	**100.0%**	**100.0%**	**100.0%**	**100.0%**		

Source: DEST Aggregated Data Sets

7. Student Load: Who Teaches? Who Learns?

By analysing patterns of student load (Equivalent Full Time Student Units or EFTSU) it is possible to gain greater insight into trends in Science teaching and learning. As was noted above, analysing course enrolments is limited because many students enrol in generalist degrees, particularly at the undergraduate level. A student enrolled in a BSc could be focusing on mathematics, physics or biology, but it is not possible to gain this level of information without analysing the discipline area of the subject the student is enrolled in. University subjects are 'weighted' according to the proportion of a year's work that subject represents, so a subject representing a quarter of a year's work will be weighted at 0.250 EFTSU. It is through this student load that HECS calculations are made. A student enrolled in a standard full time year of a university will usually generate 1.000 EFTSU by their enrolment. A student taking more than a standard year's work load will usually generate more than 1.000 EFTSU, just as a student enrolled in fewer subjects than would normally constitute a standard year's work load will generate less than 1.000 EFTSU.

The change in the classification of subjects from 'discipline groups' to 'fields of education' (from 2001) has meant that some elements of time series detail are lost, but within Science the mapping between the old and new classifications is strong. It is also important to note that the student load aggregations reported in DEST's own publications at the time, and in *Trends*, have changed.

The point of this section is to see if Science students have changed their subject selection over time, and to establish whether the leakage from Science disciplines identified in *Trends*. has continued.

Student Load: the Sector

Table 40 shows that between 1989 and 2002, the size of the student load generated by all university students increased by nearly 77%, from 354,235 EFTSU in 1989 to 626,749 EFTSU in 2002. This rate of increase is slightly higher than the expansion in enrolments noted in Table 3, which was 70.3%. This reflects the relatively higher growth in full time enrolments.

Research enrolments have generated about 5% of total student load since the 1990s, up from 3.9% in 1989, and doctoral load has increased strongly. Masters by Coursework student load increased from 8,948 EFTSU in 1989 to 54,352 EFTSU in 2002, an increase of over 500%. In absolute terms, the student load generated by bachelor degree enrolments has increased the most. In 1989, these students generated 258,525 EFTSU, but by 2002 it had risen by 88.7% to 487,866 EFTSU. In 2002, the proportion of all student load generated by bachelor students was 77.8%, compared with 73.0% in 1989, but the proportion is lower than it had been in the mid-1990s.

Table 40: Student Load (EFTSU) Generated by All Students by Level of Course

Course Level						Growth 1989 - 2002	
Number	**1989**	**1993**	**1997**	**2001**	**2002**	**No**	**%**
Doctorate by Research	8545	13849	19634	23480	24315	15770	184.5%
Masters by Research	5307	8172	7408	6425	6125	819	15.4%
Sub Total HDR	13852	22021	27042	29905	30440	16589	119.8%
Masters by Coursework	8948	18311	28529	45576	54352	45404	507.4%
Other Postgraduate	19515	25284	28790	27491	30795	11280	57.8%
Bachelor	258525	352782	412350	463700	487866	229341	88.7%
Other	53395	22688	18016	21530	23295	-30100	-56.4%
Total	**354235**	**441085**	**514727**	**588202**	**626749**	**272513**	**76.9%**
Per Cent							
Doctorate by Research	2.4%	3.1%	3.8%	4.0%	3.9%	5.8%	
Masters by Research	1.5%	1.9%	1.4%	1.1%	1.0%	0.3%	
Sub Total HDR	3.9%	5.0%	5.3%	5.1%	4.9%	6.1%	
Masters by Coursework	2.5%	4.2%	5.5%	7.7%	8.7%	16.7%	
Other Postgraduate	5.5%	5.7%	5.6%	4.7%	4.9%	4.1%	
Bachelor	73.0%	80.0%	80.1%	78.8%	77.8%	84.2%	
Other	15.1%	5.1%	3.5%	3.7%	3.7%	-11.0%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

Table 41 examines the relative growth of student load generated by students enrolled in Science, Information Technology and All Other Courses, at all course levels. Although student load generated by Science students has increased (by 31.3% between 1989 and 2002), it occurred at a time of much greater expansion in Information Technology (415.7%) and in All Other Courses (72.3%). Science's proportion of the sector's total student load has decreased from 12.2% to 9.1%, while student load generated by Information Technology students has increased from 2.8% to 8.2%.

Table 41: Student Load (EFTSU) Generated by Science, Information Technology and Other Students

Course Group						Growth 1989 - 2002	
Number	**1989**	**1993**	**1997**	**2001**	**2002**	**No**	**%**
Science Courses	43345	54433	59977	54979	56922	13577	31.3%
Information Technology Courses	9945	14793	20965	46759	51285	41339	415.7%
Science & Information Technology Courses	53290	69226	80942	101738	108206	54916	103.1%
All Other Courses	300945	371860	433785	486464	518543	217597	72.3%
Total	**354235**	**441085**	**514727**	**588202**	**626749**	**272513**	**76.9%**
Per Cent							
Science Courses	12.2%	12.3%	11.7%	9.3%	9.1%	5.0%	
Information Technology Courses	2.8%	3.4%	4.1%	7.9%	8.2%	15.2%	
Science & Information Technology Courses	15.0%	10.0%	15.7%	17.3%	17.3%	20.2%	
All Other Courses	85.0%	84.3%	84.3%	82.7%	82.7%	79.8%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

Table 42 also considers student load for the whole higher education sector, but looks at it from the point of view of groups of subject disciplines. As can be seen, the growth in the teaching of Science subjects (including behavioural Science) has lagged well behind growth overall, Information Technology subjects and Non-Science - I/T Subjects. It can also be seen that the peak year for Science subjects was 1997, but that there was quite strong growth between 2001 and 2002. As a proportion of all subjects, Science subjects declined from 21.4% in 1989 to 15.4% in 2002. This proportionate decline has been consistent over the period, and even in 1997, the high point, the proportion was less than in 1993. The strongest growth was again in Information Technology subjects, which increased by 209.4% between 1989 and 2002, but even with this growth, Science and Information Technology subjects, when summed, lost ground to other disciplines.

Table 42: Student Load (EFTSU) Generated by All students, by Subject Group

Subject Group						Growth 1989 - 2002	
Number	**1989**	**1993**	**1997**	**2001**	**2002**	**No**	**%**
Science Subjects #	75832	91909	99103	92855	96753	20921	27.6%
Information Technology Subjects	17856	24057	31139	52002	55237	37381	209.4%
Science & Information Technology Subjects	93688	115965	130242	144857	151990	58302	62.2%
Non-Science - I/T Subjects	260548	325120	384485	443345	474759	214211	82.2%
Total	**354235**	**441085**	**514727**	**588202**	**626749**	**272513**	**76.9%**
Per Cent							
Science Subjects #	21.4%	20.8%	19.3%	15.8%	15.4%	7.7%	
Information Technology Subjects	5.0%	5.5%	6.0%	8.8%	8.8%	13.7%	
Science & Information Technology Subjects	26.4%	26.3%	25.3%	24.6%	24.3%	21.4%	
Non-Science - I/T Subjects	73.6%	73.7%	74.7%	75.4%	75.7%	78.6%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets
Behavioural Science subjects have been included as Science subjects this table

Science and Information Technology Subjects: Discipline by Discipline

In this section, tables look at only Science and Information Technology subjects by discipline, considering which students those subjects are taught to. For each discipline, teaching to all university students, female students and overseas students is examined, and whether the teaching is to students enrolled in Science courses, Information Technology courses, or all other courses. Behavioural Science, a discipline taught by Science faculties at many universities has been included. Under the pre-2001 Discipline Group classification, Behavioural Science was considered to be a part of Broad Discipline Group *02 Social Science*. Redesignation in the new Field of Education classification has seen it become part of the Field of Education *09 Society & Culture*.

In the sections on enrolments, the point was made that re-badging of some generalist Science courses to specific computer or Information Technology courses provided a partial explanation for why the growth in Science enrolments was relatively modest. This is not the case so far as student load is concerned. There were always separate discipline groups for describing Information Technology subjects as opposed to subjects in other disciplines of Science.

Tables which follow consider each discipline in turn, but Table 43 provides a summary of what has happened between 1989 and 2002 in the teaching of Science disciplines.

In Table 42, the relatively lower rate of growth in Science disciplines overall, when compared with others, was shown. Table 43 shows that Science's relatively low rate of growth is was

not uniform. Over the period, there was growth in Behavioural, Biological, Earth and Other Sciences, but only in Behavioural and Biological sciences can growth be described as 'strong' (at 58.5% and 63.7% respectively). Chemistry and Mathematical Sciences declined by 4.8% and 2.0% respectively, saving the worst result for the Physical/Materials Sciences, which declined by 2,290 EFTSU, or 31.4%

The peak year in several Science disciplines occurred in 1993 for Chemistry, Earth Sciences, Mathematics and Physics, so since the rapid expansion of the immediate post-Dawkins reforms, there has been up to a decade of slippage for these disciplines. Only Biological Sciences student load has increased each year since 1989, with even Behavioural Science and Other Sciences declining between 1997 and 2001.

Table 43: Student Load (EFTSU) Generated by All students, by Subject Group

Subject Group						Growth 1989 - 2002	
	1989	**1993**	**1997**	**2001**	**2002**	**No**	**%**
Science							
Behavioural Science	14520	18197	22055	21572	23017	8497	58.5%
Biological Sciences	18637	24462	28041	28794	30512	11875	63.7%
Chemical Sciences	8003	9124	9048	7503	7621	-383	-4.8%
Earth Sciences	2792	4113	4065	3927	3897	1106	39.6%
Mathematical Sciences	20937	22813	22564	20193	20519	-417	-2.0%
Other Sciences	3659	5261	6176	5974	6192	2533	69.2%
Physical/Materials Sciences	7284	7940	7155	4892	4994	-2290	-31.4%
Science Sub Total	**75832**	**91909**	**99103**	**92855**	**96753**	**20921**	**27.6%**
Information Technology	17856	24057	31139	52002	55237	37381	209.4%
Science & Information Technology	**93688**	**115965**	**130242**	**144857**	**151990**	**58302**	**62.2%**

Source: DEST Aggregated Data Sets

The tables which follow provide summary information about each Science discipline and Information Technology. The tables examine teaching to students in Science courses, Information Technology Courses and Other Courses, and the amount and proportion of student load generated by enrolments by female students and by overseas students.

Behavioural Sciences

Table 44 looks at teaching in Behavioural Science. A relatively small proportion of Behavioural Science teaching is to Science students (2,434 EFTSU, about 10.5%), and the proportion is even smaller to Information Technology students (1.2%). Based on the observations shown here, the high point for Science students taking Behavioural Science occurred in 1997, but the overall growth between 1989 and 2002 was 74.1%. This growth rate was higher than for students in non-Science/non-Information Technology courses.

Calculating from figures shown in the table, Behavioural Science is preferred by female students, and their preference has risen. In 1989, female Science students comprised 59.7% of all Behavioural Science, and this had risen to 68.2% in 2002. However, these proportions are less than is the case for female students in Other Courses, where the female majority increased from 73.2% in 1989 to 77.2% in 2002.

Behavioural Science is not exactly popular with overseas students, most particularly those enrolled in Science courses.

Table 44: Teaching (EFTSU) in Behavioural Science to All, Female and Overseas Students

Course Group						Growth 1989 - 2002	
All Students	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Science Courses	1398	2098	2676	2412	2434	1035	74.1%
I/T Courses	175	134	170	271	270	95	54.2%
Other Courses	12947	15965	19208	18889	20313	7366	56.9%
Total	**14520**	**18197**	**22055**	**21572**	**23017**	**8497**	**58.5%**
Female Students - No.							
Science Courses	835	1342	1773	1663	1660	825	98.8%
I/T Courses	60	56	52	91	86	26	43.4%
Other Courses	9479	11699	14262	14586	15685	6206	65.5%
Total	**10375**	**13098**	**16087**	**16339**	**17432**	**7057**	**68.0%**
Female Students - %							
Science Courses	59.7%	64.0%	66.3%	69.0%	68.2%	79.7%	
I/T Courses	34.3%	42.0%	30.4%	33.4%	31.9%	27.4%	
Other Courses	73.2%	73.3%	74.3%	77.2%	77.2%	84.2%	
Total	**71.4%**	**72.0%**	**72.9%**	**75.7%**	**75.7%**	**83.1%**	
Overseas Students - No.							
Science Courses	29	36	113	185	220	191	655.8%
I/T Courses	13	10	13	38	48	35	260.5%
Other Courses	244	448	735	1226	1535	1291	528.9%
Total	**287**	**493**	**862**	**1449**	**1803**	**1517**	**529.2%**
Overseas Students - %							
Science Courses	2.1%	1.7%	4.2%	7.7%	9.0%	18.4%	
I/T Courses	7.6%	7.2%	7.9%	13.9%	17.9%	36.7%	
Other Courses	1.9%	2.8%	3.8%	6.5%	7.6%	17.5%	
Total	**2.0%**	**2.7%**	**3.9%**	**6.7%**	**7.8%**	**17.8%**	

Source: DEST Aggregated Data Sets

Biological Sciences

Table 45 examines Biological Sciences teaching. These subjects are taken principally by Science degree students, ahead of students in non-Science courses, and their rate of growth has been greatest among Science students. Biological Sciences subjects are also favoured by female students, and their proportion of total Biological Sciences teaching increased from 57.2% in 1989 to 63.8% in 2002. Among female Science students, the proportion increased from 53.2% to 60.4%.

Biological Sciences teaching to overseas Science students has also increased, more than doubling over the period. Overseas students received 4.4% of all teaching in this discipline in 1989, rising to 9.5% by 2002.

Table 45: Teaching (EFTSU) in Biological Sciences to All, Female and Overseas Students

Course Group						Growth 1989 - 2002	
All Students	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Science Courses	10648	14811	18658	17853	18712	8065	75.7%
I/T Courses	63	106	55	69	82	19	29.6%
Other Courses	7927	9545	9328	10872	11718	3791	47.8%
Total	**18637**	**24462**	**28041**	**28794**	**30512**	**11875**	**63.7%**
Female Students - No.							
Science Courses	5670	8312	10885	10787	11297	5627	99.3%
I/T Courses	32	62	21	27	31	-1	-3.1%
Other Courses	4962	6001	5902	7464	8150	3188	64.3%
Total	**10663**	**14375**	**16808**	**18277**	**19478**	**8815**	**82.7%**
Female Students - %							
Science Courses	53.2%	56.1%	58.3%	60.4%	60.4%	69.8%	
I/T Courses	50.2%	58.3%	37.9%	38.9%	37.5%	-5.2%	
Other Courses	62.6%	62.9%	63.3%	68.6%	69.6%	84.1%	
Total	**57.2%**	**58.8%**	**59.9%**	**63.5%**	**63.8%**	**74.2%**	
Overseas Students - No.							
Science Courses	549	618	970	1423	1774	1224	223.0%
I/T Courses	2	4	1	5	7	4	220.3%
Other Courses	266	413	540	915	1125	859	323.5%
Total	**817**	**1034**	**1511**	**2343**	**2905**	**2088**	**255.7%**
Overseas Students - %							
Science Courses	5.2%	4.2%	5.2%	8.0%	9.5%	15.2%	
I/T Courses	3.2%	3.3%	1.2%	7.2%	7.9%	23.9%	
Other Courses	3.4%	4.3%	5.8%	8.4%	9.6%	22.7%	
Total	**4.4%**	**4.2%**	**5.4%**	**8.1%**	**9.5%**	**17.6%**	

Source: DEST Aggregated Data Sets

Chemical Sciences

Although the teaching of Chemical Sciences increased between 1989 and 1993, it declined between 1993 and 1997, and even further to 2001 and 2002. Chemical Science's decline was greatest among students in Science courses (-502 EFTSU, or –8.5%), slightly off set by an increase in its teaching to students in Other Courses. The decline in Chemical Sciences has been in its teaching to male students, because Table 46 shows that female Science students increased the amount of the Chemical Sciences by 391 EFTS between 1989 and 2002. However, the high point for Chemical Sciences overall occurred in 1993, and for women in 1997. If the Chemical Sciences have been considered as one of the non-traditional Science disciplines for female students, the Table reveals that this is no longer the case. Gender balance was all but achieved in 1997, and the pattern of increased female participation in chemistry has continued to such an extent that women now comprise 53.2% of the recipients of teaching in the Chemical Sciences.

Overseas students have increased their consumption of Chemical Sciences, both Science and non-Science students alike.

Table 46: Teaching (EFTSU) in Chemical Sciences to All, Female and Overseas Students

Course Group						Growth 1989 - 2002	
All Students	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Science Courses	5932	6710	6753	5331	5430	-502	-8.5%
I/T Courses	56	52	32	50	41	-15	-27.4%
Other Courses	2016	2362	2263	2122	2150	134	6.7%
Total	**8003**	**9124**	**9048**	**7503**	**7621**	**-383**	**-4.8%**
Female Students - No.							
Science Courses	2532	3091	3358	2823	2924	391	46.8%
I/T Courses	11	20	8	19	12	2	2.6%
Other Courses	782	1034	989	1120	1120	338	3.6%
Total	**3325**	**4145**	**4356**	**3962**	**4056**	**731**	**7.0%**
Female Students - %							
Science Courses	42.7%	46.1%	49.7%	52.9%	53.8%		
I/T Courses	19.4%	39.2%	25.0%	38.2%	30.6%		
Other Courses	38.8%	43.8%	43.7%	52.8%	52.1%	251.7%	
Total	**41.5%**	**45.4%**	**48.1%**	**52.8%**	**53.2%**		
Overseas Students - No.							
Science Courses	328	359	377	432	548	220	67.1%
I/T Courses	4	4	2	11	4	0	0.7%
Other Courses	105	133	175	207	246	141	134.3%
Total	**437**	**497**	**554**	**650**	**799**	**361**	**82.7%**
Overseas Students - %							
Science Courses	5.5%	5.4%	5.6%	8.1%	10.1%		
I/T Courses	6.7%	8.6%	6.9%	21.4%	9.2%		
Other Courses	5.2%	5.6%	7.7%	9.8%	11.5%	105.1%	
Total	**5.5%**	**5.4%**	**6.1%**	**8.7%**	**10.5%**		

Source: DEST Aggregated Data Sets

Earth Sciences

Table 47 looks at Earth Sciences teaching, which has increased in size over the period, but among Science students it has yet to return to the level of 1997. More women are now taking Earth Sciences, with strong growth among both Science and non-Science students. The female proportion of all Earth Sciences teaching has increased from 26.4% to 41.6% among Science students.

Overseas Science students have not greatly increased the amount of Earth Sciences they study since the Dawkins reforms. Their proportion has decreased from 9.5% to 8.0% of all teaching of Earth Sciences to Science students, but has increased for overseas students enrolled in Other Courses.

Table 47: Teaching (EFTSU) in Earth Sciences to All, Female and Overseas Students

Course Group						Growth 1989 - 2002	
All Students	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Science Courses	2173	3083	3106	2925	2843	670	30.8%
I/T Courses	23	24	38	12	16	-6	-28.0%
Other Courses	596	1006	921	990	1038	442	74.2%
Total	**2792**	**4113**	**4065**	**3927**	**3897**	**1106**	**39.6%**
Female Students - No.							
Science Courses	573	1015	1122	1208	1184	610	106.4%
I/T Courses	11	9	6	3	4	-7	-63.1%
Other Courses	209	401	384	403	436	226	108.1%
Total	**794**	**1425**	**1512**	**1614**	**1623**	**830**	**104.6%**
Female Students - %							
Science Courses	26.4%	32.9%	36.1%	41.3%	41.6%	91.1%	
I/T Courses	47.6%	36.3%	16.9%	26.7%	24.4%	107.2%	
Other Courses	35.1%	39.8%	41.7%	40.7%	42.0%	51.2%	
Total	**28.4%**	**34.6%**	**37.2%**	**41.1%**	**41.6%**	**75.0%**	
Overseas Students - No.							
Science Courses	206	210	194	216	227	20	9.8%
I/T Courses	0	1	1	2	2	2	1656.4%
Other Courses	23	43	72	104	129	106	462.6%
Total	**230**	**254**	**267**	**321**	**358**	**129**	**56.1%**
Overseas Students - %							
Science Courses	9.5%	6.8%	6.2%	7.4%	8.0%	3.0%	
I/T Courses	0.6%	3.6%	2.8%	13.3%	14.4%	-35.0%	
Other Courses	3.9%	4.3%	7.8%	10.5%	12.5%	24.1%	
Total	**8.2%**	**6.2%**	**6.6%**	**8.2%**	**9.2%**	**11.6%**	

Source: DEST Aggregated Data Sets

Mathematical Sciences

Mathematics continues to be in difficulty. Despite an increase in Mathematics teaching between 2001 and 2002, the 2002 figure is 417 EFTSU less than in 1989. The high point for the teaching of Mathematics to was 1993, and in 2002 2,294 EFTSU less teaching of Mathematics subjects occurred, compared to that high point. The amount of Mathematical Sciences taken by students in Information Technology and Other Courses increased over the period, but among Science students, Mathematics declined by 2,522 EFTSU, over one third.

The proportion of female students taking Mathematical Sciences has remained fairly static, at around 38%, but the high point of mathematics teaching to women occurred in 1997. Female students enrolled in Science degrees have reduced their intake of the Mathematical Sciences, but as can be seen from the table, it is male Science students who are responsible for the decline in the extent of Mathematics teaching.

Overseas students have increased their mathematics consumption, but not those enrolled in Science degrees. Overseas students' proportion of mathematics teaching has increased from 7.2% in 1989, to 20.0% in 2002.

Table 48: Teaching (EFTSU) in Mathematical Sciences to All, Female and Overseas Students

Course Group						Growth 1989 - 2002	
All Students	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Science Courses	7520	7756	6512	4963	4968	-2552	-33.9%
I/T Courses	1558	1708	2227	3043	2874	1316	84.5%
Other Courses	11859	13349	13825	12186	12677	818	6.9%
Total	**20937**	**22813**	**22564**	**20193**	**20519**	**-417**	**-2.0%**
Female Students - No.							
Science Courses	2753	3012	2724	2157	2157	-596	-21.7%
I/T Courses	428	454	465	709	626	198	46.4%
Other Courses	4397	5198	5245	4781	5052	655	14.9%
Total	**7578**	**8665**	**8435**	**7647**	**7835**	**257**	**3.4%**
Female Students - %							
Science Courses	36.6%	38.8%	41.8%	43.5%	43.4%	23.4%	
I/T Courses	27.5%	26.6%	20.9%	23.3%	21.8%	15.1%	
Other Courses	37.1%	38.9%	37.9%	39.2%	39.9%	80.0%	
Total	**36.2%**	**38.0%**	**37.4%**	**37.9%**	**38.2%**	**-61.7%**	
Overseas Students - No.							
Science Courses	540	512	427	427	483	-57	-10.6%
I/T Courses	171	268	360	962	973	803	469.6%
Other Courses	800	1245	2050	2199	2645	1845	230.5%
Total	**1511**	**2024**	**2837**	**3587**	**4102**	**2591**	**171.4%**
Overseas Students - %							
Science Courses	7.2%	6.6%	6.6%	8.6%	9.7%	2.2%	
I/T Courses	11.0%	15.7%	16.2%	31.6%	33.9%	61.0%	
Other Courses	6.7%	9.3%	14.8%	18.0%	20.9%	225.4%	
Total	**7.2%**	**8.9%**	**12.6%**	**17.8%**	**20.0%**	**-620.7%**	

Source: DEST Aggregated Data Sets

Other Sciences

Other Sciences includes teaching in pharmacology, medical science, forensic medicine, food science, biotechnology and laboratory technology, and as a group, is growing. Teaching in this group of disciplines increased by 69.2% between 1989 and 2002.

Female students are now in the majority in both Science and Other Courses.

Overseas students increased their proportion of subjects taught in Other Sciences, and this was particularly the case for those enrolled in Science courses.

Table 49: Teaching (EFTSU) in Other Sciences to All, Female and Overseas Students

Course Group						Growth 1989 - 2002	
All Students	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Science Courses	1617	2641	3375	3162	3406	1790	110.7%
I/T Courses	8	25	48	47	18	10	119.5%
Other Courses	2034	2594	2753	2765	2768	734	36.1%
Total	**3659**	**5261**	**6176**	**5974**	**6192**	**2533**	**69.2%**
Female Students - No.							
Science Courses	789	1242	1736	1858	2027	1238	157.0%
I/T Courses	5	4	8	11	4	-1	-21.0%
Other Courses	1160	1575	1653	1751	1726	567	48.9%
Total	**1953**	**2822**	**3397**	**3619**	**3757**	**1804**	**92.4%**
Female Students - %							
Science Courses	48.8%	47.0%	51.5%	58.8%	59.5%	69.2%	
I/T Courses	57.4%	17.7%	17.3%	22.6%	20.7%	-10.1%	
Other Courses	57.0%	60.7%	60.0%	63.3%	62.4%	77.2%	
Total	**53.4%**	**53.6%**	**55.0%**	**60.6%**	**60.7%**	**71.2%**	
Overseas Students - No.							
Science Courses	180	206	308	444	559	380	211.0%
I/T Courses	0	8	8	11	2	2	742.9%
Other Courses	133	173	234	236	263	129	96.9%
Total	**314**	**386**	**551**	**691**	**824**	**510**	**162.8%**
Overseas Students - %							
Science Courses	11.1%	7.8%	9.1%	14.0%	16.4%	21.2%	
I/T Courses	2.5%	29.9%	16.9%	22.6%	9.6%	15.5%	
Other Courses	6.6%	6.7%	8.5%	8.5%	9.5%	17.6%	
Total	**8.6%**	**7.3%**	**8.9%**	**11.6%**	**13.3%**	**20.1%**	

Source: DEST Aggregated Data Sets

Physical/Materials Sciences

Physical/Materials Sciences continue to decline, in all course groups identified in Table 50. The decline in teaching to students in Other Courses was greater than it was in Science courses, but this will be of little comfort to deans of Science. Physical/Materials Science teaching amounted to 2,290 EFTSU less in 2002 that had been the case in 1989, and 2,946 EFTSU lower than for Physics' peak in 1993. Financially speaking, this represents a huge decline in funding for faculties of Science.

Female Science students increased their proportion of Physics, but the 2002 result was scarcely larger than in 1989. For women, 1997 represents the high point for studying Physical/ Materials Science subjects.

Only overseas students have increased their relative presence, but this has only occurred because domestic students have continued their disinclination to study physics.

Table 50: Teaching in (EFTSU) Physical/Materials Sciences to All, Female and Overseas Students

Course Group						Growth 1989 - 2002	
All Students	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Science Courses	3612	3730	3351	2527	2707	-906	-25.1%
I/T Courses	152	218	151	171	129	-24	-15.6%
Other Courses	3519	3991	3653	2194	2159	-1361	-38.7%
Total	**7284**	**7940**	**7155**	**4892**	**4994**	**-2290**	**-31.4%**
Female Students - No.							
Science Courses	938	1130	1150	852	948	10	1.1%
I/T Courses	20	26	15	28	15	-5	-25.0%
Other Courses	809	941	850	498	498	-310	-38.4%
Total	**1767**	**2097**	**2014**	**1378**	**1462**	**-305**	**-17.3%**
Female Students - %							
Science Courses	26.0%	30.3%	34.3%	33.7%	35.0%		
I/T Courses	13.2%	12.1%	9.9%	16.2%	11.7%	-21.1%	
Other Courses	23.0%	23.6%	23.3%	22.7%	23.1%	-22.8%	
Total	**24.3%**	**26.4%**	**28.1%**	**28.2%**	**29.3%**	**-13.3%**	
Overseas Students - No.							
Science Courses	233	226	202	274	291	58	24.8%
I/T Courses	16	18	14	33	27	11	71.0%
Other Courses	228	293	396	294	311	83	36.5%
Total	**477**	**537**	**612**	**601**	**629**	**152**	**31.9%**
Overseas Students - %							
Science Courses	6.5%	6.1%	6.0%	10.9%	10.8%		
I/T Courses	10.4%	8.4%	9.1%	19.2%	21.2%		
Other Courses	6.5%	7.3%	10.8%	13.4%	14.4%		
Total	**6.5%**	**6.8%**	**8.6%**	**12.3%**	**12.6%**		

Source: DEST Aggregated Data Sets

Information Technology

Information Technology has boomed since 1989. Information Technology teaching has increased by 37,381 EFTSU over the period, an increase of 209.4%. The decline in Information Technology taken by Science students is in part a reflection of the course re-badging mentioned in earlier sections.

The proportion of student load in Information Technology subjects has remained almost constant over the period, at around 30%, but there has been strong absolute growth in teaching Information Technology to women, an increase of 10,134, or 183.6%. However, this strong rate of growth was outstripped by male Information Technology students.

The majority of the growth has been in Information Technology teaching to overseas students (21,132 EFTSU out of total growth of 37,381 EFTSU), and overseas students now represent 41.3% of all Information Technology teaching, up from 9.5% in 1989.

Table 51: Teaching (EFTSU) in Information Technology to All, Female and Overseas Students

Course Group						Growth 1989 - 2002	
All Students	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Science Courses	3212	3142	2672	2207	1838	-1374	-42.8%
I/T Courses	6111	9832	14153	32923	36712	30601	500.8%
Other Courses	8534	11082	14314	16872	16687	8154	95.5%
Total	**17856**	**24057**	**31139**	**52002**	**55237**	**37381**	**209.4%**
Female Students - No.							
Science Courses	903	927	777	660	560	-344	-38.0%
I/T Courses	1508	2509	3080	8024	8696	7188	476.7%
Other Courses	3110	4299	5820	6501	6399	3289	105.8%
Total	**5521**	**7734**	**9677**	**15185**	**15655**	**10134**	**183.6%**
Female Students - %							
Science Courses	28.1%	29.5%	29.1%	29.9%	30.5%	25.0%	
I/T Courses	24.7%	25.5%	21.8%	24.4%	23.7%	23.5%	
Other Courses	36.4%	38.8%	40.7%	38.5%	38.3%	40.3%	
Total	**30.9%**	**32.2%**	**31.1%**	**29.2%**	**28.3%**	**27.1%**	
Overseas Students - No.							
Science Courses	290	286	184	360	227	-63	-21.8%
I/T Courses	539	1491	2951	14077	17102	16563	3073.8%
Other Courses	865	1563	3312	5344	5497	4632	535.5%
Total	**1694**	**3340**	**6447**	**19780**	**22825**	**21132**	**1247.7%**
Overseas Students - %							
Science Courses	9.0%	9.1%	6.9%	16.3%	12.3%	4.6%	
I/T Courses	8.8%	15.2%	20.9%	42.8%	46.6%	54.1%	
Other Courses	10.1%	14.1%	23.1%	31.7%	32.9%	56.8%	
Total	**9.5%**	**13.9%**	**20.7%**	**38.0%**	**41.3%**	**56.5%**	

Source: DEST Aggregated Data Sets

Science Students: What is Science?

The analysis and tables above lead to an important question: how has the content of a Science degree changed since the time of the Dawkins reforms? The answer to this question is summarised in Table 52, and shown also in Figure 12.

The content of a 'Science degree' (all levels) has changed extensively since 1989. The table below describes the average Science course in the years of observation. Biology subjects have shown the greatest increase, rising by 8,065 or 75.7%, but the next big mover was non-Science subjects. The proportion of non-Science subjects has risen from 16.7% in 1989, to 25.6% in 2002. The big losers have been the 'traditional' Science areas of Chemical, Mathematical and Physical/Materials Sciences. Information Technology teaching to Science students has also declined, but much, if not all, of this decline has been due to BSc courses being re-branded over time to Information Technology courses. Biological Sciences have gone from being about one quarter of the 'average' Science course, to one third. The Earth Sciences have increased in size over time, but in 2002 represented the same proportion of a Science degree as in 1989.

Table 52: Science Students: Subject Group of Subjects Studied (EFTSU)

Subject Group						Growth 1989 - 2002	
EFTSU	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Behavioural Sciences	1398	2098	2676	2412	2434	1035	74.1%
Biological Sciences	10648	14811	18658	17853	18712	8065	75.7%
Chemical Sciences	5932	6710	6753	5331	5430	-502	-8.5%
Earth Sciences	2173	3083	3106	2925	2843	670	30.8%
Mathematical Sciences	7520	7756	6512	4963	4968	-2552	-33.9%
Other Sciences	1617	2641	3375	3162	3406	1790	110.7%
Physical/Materials Sciences	3612	3730	3351	2527	2707	-906	-25.1%
Sub Total Science Subjects	**32900**	**40829**	**44431**	**39173**	**40500**	**7600**	**23.1%**
Information Technology	3212	3142	2672	2207	1838	-1374	-42.8%
Non-Science/I/T	7234	10461	12875	13598	14584	7350	101.6%
Total	**43345**	**54433**	**59977**	**54979**	**56922**	**13577**	
Per Cent							
Behavioural Sciences	3.2%	3.9%	4.5%	4.4%	4.3%	7.6%	
Biological Sciences	24.6%	27.2%	31.1%	32.5%	32.9%	59.4%	
Chemical Sciences	13.7%	12.3%	11.3%	9.7%	9.5%	-3.7%	
Earth Sciences	5.0%	5.7%	5.2%	5.3%	5.0%	4.9%	
Mathematical Sciences	17.3%	14.2%	10.9%	9.0%	8.7%	-18.8%	
Other Sciences	3.7%	4.9%	5.6%	5.8%	6.0%	13.2%	
Physical/Materials Sciences	8.3%	6.9%	5.6%	4.6%	4.8%	-6.7%	
Sub Total Science Subjects	**75.80%**	**75.10%**	**74.20%**	**71.30%**	**71.20%**	**55.90%**	
Information Technology	7.4%	5.8%	4.5%	4.0%	3.2%	-10.1%	
Non-Sci/I/T	16.7%	19.2%	21.5%	24.7%	25.6%	54.1%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

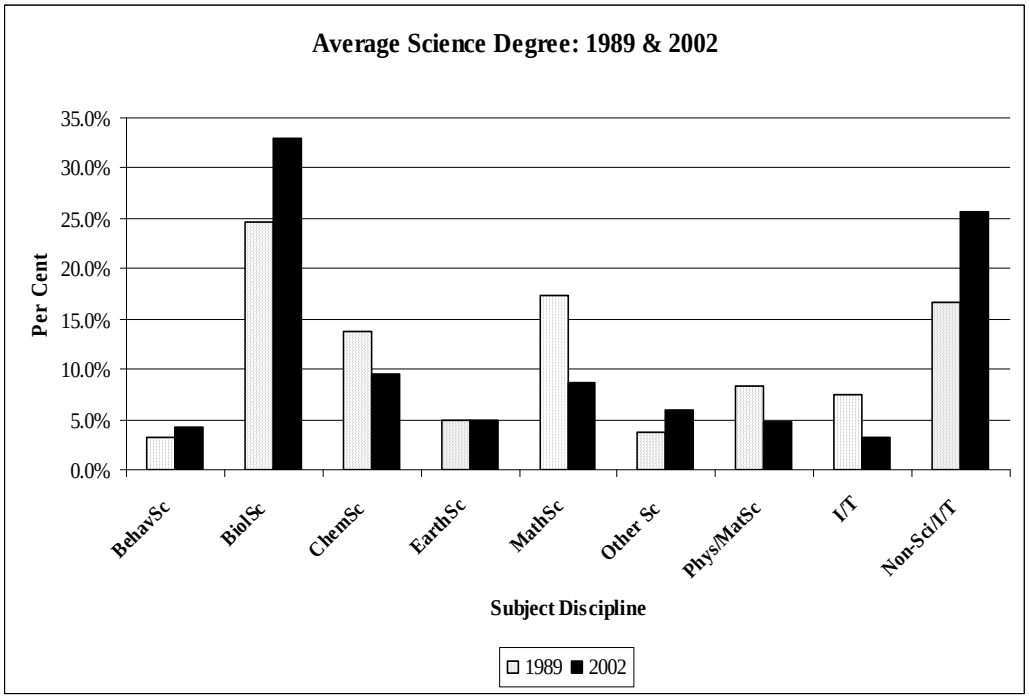

Figure 12 Average Science Degree 1989 c.f. 2002

8. PhD In Depth: Enrolments, Student Load and Course Completions

This section is intended to provide an 'in depth' look at patterns of enrolments, course completions and student load in Science and Information Technology PhDs.

Table 53 summarises patterns of Science and Information Technology higher degree by research enrolments 1989 – 2002, and it can be seen that PhD enrolments represent the largest, and a growing, proportion of this group of courses. The proportion of PhDs in Science has increased from 64.2% of all HDR enrolments in 1989, to 84.2% in 2002. Given that the number of masters by research enrolments declined over the period, it could be that more students now go straight into a PhD, rather than via a masters degree.

In Information Technology, total numbers are much smaller than in Science, and the number of masters by research enrolments has increased.

Table 53: Higher Degree by Research Enrolments in Science/Information Technology Courses

Course Level						Growth 1989 - 2002	
	1989	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Science & I/T							
Higher Doctorate	9	24	2				
PhD	**2825**	**4938**	**6853**	**7188**	**7328**	**4503**	**159.4%**
Masters by Research	1566	2616	2157	1491	1378	-188	-12.0%
Total	4400	7578	9012	8679	8706	4306	97.9%
% PhD	**64.2%**	**65.2%**	**76.0%**	**82.8%**	**84.2%**	**104.6%**	

Source: DEST Aggregated Data Sets

The rest of the tables in this section consider PhD enrolments only, distributed between four sub-classifications of Science courses, plus Information Technology. Table 54 shows that most enrolments occur in the Life Sciences, comprising between 34.5% and 45.6% over the period. However, it is clear that some universities do not code their PhD enrolments specifically to discipline areas. This judgment is based on the large number of General/Other PhD enrolments. All discipline areas of PhD enrolments have more than doubled in enrolments between 1989 and 2002, with the greatest expansion being in the life sciences. Numbers in Mathematical Sciences are lower than in other course groups, and apart from strong growth in earlier years, have oscillated somewhat. Physical Sciences PhD enrolments increased strongly until 2001, but declined in number between 2001 and 2002. Life Sciences also shed numbers between 2001 and 2002. Information Technology PhD enrolments have shown a constant upward trend, and the proportionate growth in this area has been 635.3% over the period.

Table 54: PhD Enrolments in Science/Information Technology Courses - By Course Group

Course Group						Growth 1989 - 2002	
Number	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
General/Other Science Courses	489	925	1639	765	1004	515	105.3%
Life Sciences Courses	1136	1754	2364	3279	3107	1971	173.5%
Mathematical Sciences Courses	150	365	415	362	364	214	142.7%
Physical Sciences Courses	931	1495	1777	2011	1978	1047	112.5%
Information Technology Courses	119	399	658	771	875	756	635.3%
Total	**2825**	**4938**	**6853**	**7188**	**7328**	**4503**	**159.4%**
Per Cent							
General/Other Science Courses	17.3%	18.7%	23.9%	10.6%	13.7%	11.4%	
Life Sciences Courses	40.2%	35.5%	34.5%	45.6%	42.4%	43.8%	
Mathematical Sciences Courses	5.3%	7.4%	6.1%	5.0%	5.0%	4.8%	
Physical Sciences Courses	33.0%	30.3%	25.9%	28.0%	27.0%	23.3%	
Information Technology Courses	4.2%	8.1%	9.6%	10.7%	11.9%	16.8%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

Female and Male PhD Students

Table 55 looks at PhD enrolments by sex. For female students, the rate of growth between 1989 and 2002 has been strong in all sub-fields of Science, although numbers remain modest in Mathematical Sciences and Information Technology. More than half the growth in PhD enrolments was generated by women. Women's preference for the Life Sciences is clear, with 1997 being the lowest point with 43.3% of female PhD students. However, this was also the year in which the proportion in General/Other PhD courses was highest, and it is likely that some female students in this category were in fact undertaking a Life Sciences PhD. The proportions enrolled in Mathematical and Physical Sciences have been fairly consistent, at around 3-4% in the former, and 21-23% in the latter. The proportions of female students within fields of study/education has not changed much, and in 2002 about half were enrolled in a Life Sciences PhD, and slightly less than one quarter were enrolled in Physical Sciences PhDs.

So far as male students are concerned, growth rates over the period have been more modest, coming from a higher base. As with female students, the largest proportion of male students enrol in Life Sciences courses (35.8% of all male PhDs in 2002), followed by enrolments in the Physical Sciences (30.1%).

Table 55: PhD Enrolments in Science/Information Technology Courses - By Sex

Course Group						Growth 1989 - 2002	
Female Students	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Number							
General/Other Science Courses	143	321	664	366	491	348	243.4%
Life Sciences Courses	438	796	1084	1655	1606	1168	266.7%
Mathematical Sciences Courses	26	74	94	111	106	80	307.7%
Physical Sciences Courses	187	352	531	708	715	528	282.4%
Information Technology Courses	17	68	130	171	215	198	1164.7%
Total	**811**	**1611**	**2503**	**3011**	**3133**	**2322**	**286.3%**
Per Cent							
General/Other Science Courses	17.6%	19.9%	26.5%	12.2%	15.7%	15.0%	
Life Sciences Courses	54.0%	49.4%	43.3%	55.0%	51.3%	50.3%	
Mathematical Sciences Courses	3.2%	4.6%	3.8%	3.7%	3.4%	3.4%	
Physical Sciences Courses	23.1%	21.8%	21.2%	23.5%	22.8%	22.7%	
Information Technology Courses	2.1%	4.2%	5.2%	5.7%	6.9%	8.5%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	
Male Students							
Number							
General/Other Science Courses	346	604	975	399	513	167	48.3%
Life Sciences Courses	698	958	1280	1624	1501	803	115.0%
Mathematical Sciences Courses	124	291	321	251	258	134	108.1%
Physical Sciences Courses	744	1143	1246	1303	1263	519	69.8%
Information Technology Courses	102	331	528	600	660	558	547.1%
Total	**2014**	**3327**	**4350**	**4177**	**4195**	**2181**	**108.3%**
Per Cent							
General/Other Science Courses	17.2%	18.2%	22.4%	9.6%	12.2%	7.7%	
Life Sciences Courses	34.7%	28.8%	29.4%	38.9%	35.8%	36.8%	
Mathematical Sciences Courses	6.2%	8.7%	7.4%	6.0%	6.2%	6.1%	
Physical Sciences Courses	36.9%	34.4%	28.6%	31.2%	30.1%	23.8%	
Information Technology Courses	5.1%	9.9%	12.1%	14.4%	15.7%	25.6%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

Table 56 looks at the proportion of female Science and Information Technology PhD students to all PhD students (ie female enrolments in Table 55 divided by equivalent rows in Table 54). PhD enrolments by women have increased from 28.7% in 1989 to 42.8% in 2002, and it can be seen that in the Life Sciences, enrolments by female students are now in the majority. Women have not embraced Mathematical Sciences or Information Technology to the same extent (29.1% and 24.6%, respectively in 2002) and have reached only 36.1% of all PhD enrolments in the Physical Sciences. Over the period 1989 – 2002, 51.6% of the growth in PhD enrolments in Physical Sciences courses was by women.

Table 56: PhD Enrolments in Science/Information Technology Courses - By Female % of Total

Female % of All	1989	1993	1997	2001	2002
General/Other Science Courses	29.2%	34.7%	40.5%	47.8%	48.9%
Life Sciences Courses	38.6%	45.4%	45.9%	50.5%	51.7%
Mathematical Sciences Courses	17.3%	20.3%	22.7%	30.7%	29.1%
Physical Sciences Courses	20.1%	23.5%	29.9%	35.2%	36.1%
Information Technology Courses	14.3%	17.0%	19.8%	22.2%	24.6%
Total	**28.7%**	**32.6%**	**36.5%**	**41.9%**	**42.8%**

Source: DEST Aggregated Data Sets

Tables 57 and 58 consider the distribution of enrolments by domestic and overseas PhD students. Domestic students predominate in the Life Sciences, representing 49% of Science PhD enrolments, and 43.5% of Science and Information Technology PhDs. Apart from the growth of Information Technology PhD enrolments, of 710.5% between 1989 and 2002 (off a low base), Life Science PhD enrolments grew the most, by 205.6%. However, there were fewer Life Science PhDs in 2002 than there had been in 2001, a characteristic shared by Physics PhD enrolments. Mathematics PhD enrolments peaked in 1997, and were still well short of that peak in 2002.

Overseas PhD students are more likely to be enrolled in Information Technology courses than are domestic students. Whereas 11.1% of domestic PhD students were enrolled in Information Technology 2002, the figure for overseas students was 16.9%. As with domestic students, overseas PhD students' main field was the Life Sciences, although at a much lower rate.

Table 57: PhD Enrolments in Science/Information Technology Courses -By Domestic & Overseas Students

Course Group						Growth 1989 - 2002	
Domestic Students	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Number							
General/Other Science Courses	409	803	1457	645	851	442	108.1%
Life Sciences Courses	893	1427	2042	2863	2729	1836	205.6%
Mathematical Sciences Courses	126	300	354	286	308	182	144.4%
Physical Sciences Courses	701	1146	1512	1742	1691	990	141.2%
Information Technology Courses	86	315	552	610	697	611	710.5%
Total	**2215**	**3991**	**5917**	**6146**	**6276**	**4061**	**183.3%**
Per Cent							
General/Other Science Courses	18.5%	20.1%	24.6%	10.5%	13.6%	10.9%	
Life Sciences Courses	40.3%	35.8%	34.5%	46.6%	43.5%	45.2%	
Mathematical Sciences Courses	5.7%	7.5%	6.0%	4.7%	4.9%	4.5%	
Physical Sciences Courses	31.6%	28.7%	25.6%	28.3%	26.9%	24.4%	
Information Technology Courses	3.9%	7.9%	9.3%	9.9%	11.1%	15.0%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	
Overseas Students							
Number							
General/Other Science Courses	80	122	182	120	153	73	91.3%
Life Sciences Courses	243	327	322	416	378	135	55.6%
Mathematical Sciences Courses	24	65	61	76	56	32	133.3%
Physical Sciences Courses	230	349	265	269	287	57	24.8%
Information Technology Courses	33	84	106	161	178	145	439.4%
Total	**610**	**947**	**936**	**1042**	**1052**	**442**	**72.5%**
Per Cent							
General/Other Science Courses	13.1%	12.9%	19.4%	11.5%	14.5%	16.5%	
Life Sciences Courses	39.8%	34.5%	34.4%	39.9%	35.9%	30.5%	
Mathematical Sciences Courses	3.9%	6.9%	6.5%	7.3%	5.3%	7.2%	
Physical Sciences Courses	37.7%	36.9%	28.3%	25.8%	27.3%	12.9%	
Information Technology Courses	5.4%	8.9%	11.3%	15.5%	16.9%	32.8%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

Table 58 looks at the proportion overseas PhD students make up of all Science/Information Technology PhD students (ie, overseas students from Table 57, divided by equivalent rows from Table 54). The proportion has declined, from 21.6% in 1989, to 14.4% in 2002 in all course groups.

Table 58: PhD Enrolments in Science/Information Technology Courses - By Per Cent Overseas Students

Course Group	1989	1993	1997	2001	2002
General/Other Science Courses	16.4%	13.2%	11.1%	15.7%	15.2%
Life Sciences Courses	21.4%	18.6%	13.6%	12.7%	12.2%
Mathematical Sciences Courses	16.0%	17.8%	14.7%	21.0%	15.4%
Physical Sciences Courses	24.7%	23.3%	14.9%	13.4%	14.5%
Information Technology Courses	27.7%	21.1%	16.1%	20.9%	20.3%
Total	**21.6%**	**19.2%**	**13.7%**	**14.5%**	**14.4%**

Source: DEST Aggregated Data Sets

Full Time, Part Time and External PhD enrolments

The next tables look at PhD enrolments according to how students attend: full time, part time or external.

Table 59 considers PhD and Information Technology PhD students enrolled externally. Although numbers of external enrolments have increased, few Science and Information Technology students enrol this way. Spectacular rates of growth are a result of the low base in 1989.

Table 59: PhD Enrolments in Science/Information Technology Courses – By External Students

Course Group						Growth 1989 - 2002	
Number~~s~~	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
General/Other Science Courses	9	16	37	19	25	16	177.8%
Life Sciences Courses	21	21	40	74	90	69	328.6%
Mathematical Sciences Courses	4		6	5	6	2	50.0%
Physical Sciences Courses	6	2	25	50	38	32	533.3%
Information Technology Courses		1	10	22	33	33	
Total	**40**	**40**	**118**	**170**	**192**	**152**	**380.0%**
Per Cent							
General/Other Science Courses	22.5%	40.0%	31.4%	11.2%	13.0%	10.5%	
Life Sciences Courses	52.5%	52.5%	33.9%	43.5%	46.9%	45.4%	
Mathematical Sciences Courses	10.0%	0.0%	5.1%	2.9%	3.1%	1.3%	
Physical Sciences Courses	15.0%	5.0%	21.2%	29.4%	19.8%	21.1%	
Information Technology Courses	0.0%	2.5%	8.5%	12.9%	17.2%	21.7%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

Tables 60 and 61 examine full time and part time PhD enrolments.

Table 60: PhD Enrolments in Scie nce/Information Technology Courses – By Full Time Students

Course Group						Growth 1989 - 2002	
Numbers	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
General/Other Science Courses	378	723	1213	570	796	418	110.6%
Life Sciences Courses	834	1365	1772	2461	2328	1494	179.1%
Mathematical Sciences Courses	94	274	303	264	260	166	176.6%
Physical Sciences Courses	810	1236	1393	1593	1541	731	90.2%
Information Technology Courses	85	276	424	459	524	439	516.5%
Total	**2201**	**3874**	**5105**	**5347**	**5449**	**3248**	**147.6%**
Per Cent							
General/Other Science Courses	17.2%	18.7%	23.8%	10.7%	14.6%	12.9%	
Life Sciences Courses	37.9%	35.2%	34.7%	46.0%	42.7%	46.0%	
Mathematical Sciences Courses	4.3%	7.1%	5.9%	4.9%	4.8%	5.1%	
Physical Sciences Courses	36.8%	31.9%	27.3%	29.8%	28.3%	22.5%	
Information Technology Courses	3.9%	7.1%	8.3%	8.6%	9.6%	13.5%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

Table 61: PhD Enrolments in Science/Information Technology Courses – By Part Time Students

Course Group						Growth 1989 - 2002	
Numbers	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
General/Other Science Courses	102	186	389	176	183	81	79.4%
Life Sciences Courses	281	368	552	744	689	408	145.2%
Mathematical Sciences Courses	52	91	106	93	98	46	88.5%
Physical Sciences Courses	115	257	359	368	399	284	247.0%
Information Technology Courses	34	122	224	290	318	284	835.3%
Total	**584**	**1024**	**1630**	**1671**	**1687**	**1103**	**188.9%**
Per Centnt							
General/Other Science Courses	17.5%	18.2%	23.9%	10.5%	10.8%	7.3%	
Life Sciences Courses	48.1%	35.9%	33.9%	44.5%	40.8%	37.0%	
Mathematical Sciences Courses	8.9%	8.9%	6.5%	5.6%	5.8%	4.2%	
Physical Sciences Courses	19.7%	25.1%	22.0%	22.0%	23.7%	25.7%	
Information Technology Courses	5.8%	11.9%	13.7%	17.4%	18.9%	25.7%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

PhD Course Completions

This section provides detail of completions by Science and Information Technology PhD students. Table 62 summarises completions by course grouping, and shows Science's 'place' compared with Information Technology PhDs and All Other PhDs. As can be seen, Science and Information Technology have moved from providing 40.0% of the sector's PhD graduates in 1989, down to 31.4% in 2001. Overall, the number of Science and Information Technology PhDs earned increased by 733, or 151.4% between 1989 and 2001. Science PhD completions grew by 137.1% off a high base, but the rest of the sector has expanded much more in this area.

Table 62: PhD Course Completions by All Students

Course Group ~~Course Grouping~~	1989	1993	1997	2001	Growth 1989 - 2001 No.	%
Number						
Science	472	604	1043	1119	647	137.1%
Information Technology	12	26	107	98	86	716.7%
Science & Information Technology	484	630	1150	1217	733	151.4%
All Other	725	1151	2191	2659	1934	266.8%
Total	**1209**	**1781**	**3341**	**3876**	**2667**	**220.6%**
Per Cent						
Science	39.0%	33.9%	31.2%	28.9%	24.3%	
Information Technology	1.0%	1.5%	3.2%	2.5%	3.2%	
Science & Information Technology	40.0%	35.4%	34.4%	31.4%	27.5%	
All Other	60.0%	64.6%	65.6%	68.6%	72.5%	
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	

Source: DEST Aggregated Data Sets

When seeking to provide more detail, one finds that with the change of classification from 2001, the mapping between old and new classifications is ambiguous. In particular, it is likely that there is overlap between General/Other degrees and Life Sciences degrees, but even if the two categories were added together, a perfect time series still would not be possible. An earlier section of this study attempted to explain the reasons for much of the ambiguity. Table 63 examines only course completions by students enrolled in Science and Information Technology PhDs. There is clearly some discontinuity between 1997 and 2001 for completions in General/Other PhDs, and it is likely that the imposition of the new classification of courses from 2001 has been the cause of this. The overriding problem is that in every year, many of the course completions reported as General could in fact be classified more tightly to one of the sub-classifications of Science.

Table 63: PhD Course Completions – Science/Information Technology Students – All Students

Course Group					Growth 1989 - 2001	
Summary	**1989**	**1993**	**1997**	**2001**	**No.**	**%**
General/Other	92	97	287	155	63	68.5%
Life Sciences	212	234	381	521	309	145.8%
Mathematical Sciences	29	35	81	75	46	158.6%
Physical Sciences	139	238	294	368	229	164.7%
All Science	**472**	**604**	**1043**	**1119**	**647**	**137.1%**
Information Technology	12	26	107	98	86	716.7%
Total	**484**	**630**	**1150**	**1217**	**733**	**151.4%**

Source: DEST Aggregated Data Sets

Table 64 provides a much greater level of detail that did Table 63. Where the old and new classifications were described in identical or unequivocal fashion, data for all years have been shown on one row. Where there was some difference or other, old and new codes and descriptions are shown separately.

Table 64: PhD Course Completions – Science/Information Technology Students – All Students

Course Group	FOS	FOE				
	1989-2000	2001+	1989	1993	1997	2001
General/Other						
Natural & Physical Sciences		010000				12
Other Natural & Physical Sciences		019900				13
Medical Science	070501	019901	3	7	30	20
Food Science and Technology		019905				7
Pharmacology	090312	019907	3	9	10	26
Lab Technology		019909				3
Natural & Physical Sciences n.e.c.		019999				74
Medical Technology	070405		2	1	13	
Science - General		090101	84	80	234	
General/Other - Total			**92**	**97**	**287**	**155**
Life Sciences						
Biological Sciences	090304	010900	24	48	95	123
Life, General Sciences - General	090301		8	7	9	
Biochemistry and Cell Biology	090303	010901	19	32	43	72
Botany	090305	010903	27	22	33	51
Ecology and Evolution		010905				16
Marine Science		010907				19
Genetics		010909				9
Microbiology	090311	010911	14	15	36	46
Human Biology		010913				36
Zoology	090314	010915	30	17	36	38
Biological Sciences, n.e.c.		010999				37
Environmental Studies	090306	050900	15	18	40	35
Environmental Studies n.e.c		050999				20
Human Movement	090309	069903	5	6	15	19
Anatomy	090302		6	5	24	
Food Science and Technology	090307		5	2	11	
Physiology	090313		13	14	14	
Life, General Sciences - Other	090399		46	48	25	
Life Sciences - Total			**212**	**234**	**381**	**521**
Mathematical Sciences						
Mathematical Sciences		010100				11
Mathematics	090401	010101	17	23	68	51
Applied Mathematics	090402		2	5	3	
Pure Mathematics	090403		1		1	
Statistics	090404	010103	7	3	5	9
Mathematical Sciences, n.e.c.	090499	010199	2	4	4	4
Mathematical Sciences - Total			**29**	**35**	**81**	**75**
Physical Sciences						
Soil Science	010204	010709	5	9	14	7
Physics & Astronomy		010300				31
Physics	090505	010301	28	67	80	87
Chemical Sciences	090502	010500	56	89	121	107
Organic Chemistry		010501				14
Inorganic Chemistry		010503				2
Chemical Sciences, n.e.c.		010599				32
Atmospheric Sciences		010701				1
Geology	090503	010703	38	47	45	40
Geophysics		010705				2
Earth Sciences, n.e.c.		010799				12
Physical Sciences - General	090501		7	14	30	
Physical Sciences - Other	090599		5	12	4	
Physical Sciences - Total			**139**	**238**	**294**	**368**
Information Technology						
Information Technology - General		020000				8
Computer Science	090202	020100	12	18	56	40
Computer Science n.e.c.		020199				15
Information Systems - General	090203	020300		1	4	2
Systems Analysis & Design		020305				1
Information Systems - n.e.c.		020399				5
Other Information Technology	090299	029900			3	3
Information Technology n.e.c		029999				24
Computer Science/Info Systems General	090201			7	44	
Information Technology - Total			**12**	**26**	**107**	**98**

Source: DEST Aggregated Data Sets

Student Load: More Ddetail about PhD Sstudents' Aareas of Iinterest

The tables below examine the distribution of Science PhD students according to the discipline they are enrolled in, and consider variations between female and male students, and domestic and overseas students.

All Science PhD Sstudents

Table 65 looks at the PhD teaching to all Science students, and shows that it almost doubled between 1989 and 2002. Biological Sciences is clearly the most popular of all the disciplines. Student load has more than doubled over the period, and also increased its proportion of all PhD teaching, from 38.2% in 1989 to 40.5% in 2002. Good growth was demonstrated in Earth Sciences and Other Sciences, but growth in Chemical and Physical/Materials Sciences was more limited. Growth in Mathematical Science PhDs was also strong, and represented just over 5% of all PhD teaching in both 1989 and 2002.

Behavioural Science teaching to Science PhD students is fairly limited. Perhaps PhD students in the behavioural sciences are enrolled in arts or the social sciences.

The growth in teaching from non-Science disciplines has been considerable. It has increased by 448 EFTSU, or 261% between 1989 and 2002, and in fact teaching in these non-Science disciplines was higher in 2001 than in 2002. Teaching in non-Science disciplines represented 5.8% of all PhD teaching to Science students in 1989, and it had risen to 10.7% by 2002 (in 2001, it had been 12.1%). Apart from PhD teaching in the Biological Sciences, which is about 40% of teaching to Science PhD students, Non-Science teaching is at a very similar level to Science staples Chemical Sciences and Earth Sciences, and Other Science.

Table 65: Student Load (EFTSU) by Discipline for Science PhD Students

Subject Group						Growth 1989 - 2002	
All Science PhD Students - EFTSU	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Behavioural Science	6	19	40	40	49	43	688.2%
Biological Sciences	1125	1468	2138	2203	2342	1217	108.1%
Chemical Sciences	564	696	774	715	669	105	18.6%
Earth Sciences	264	447	437	598	627	363	137.6%
Mathematical Sciences	166	373	429	337	309	143	85.9%
Other Sciences	235	335	556	572	646	412	175.6%
Physical/Materials Sciences	394	474	553	496	512	118	29.9%
Information Technology	16	51	51	10	12	-4	-26.8%
Other Subject Group	172	319	503	683	620	448	261.0%
Total	**2943**	**4184**	**5480**	**5654**	**5787**	**2844**	**96.7%**

Source: DEST Aggregated Data Sets

Female Science PhD sStudents

Table 66 shows that teaching to female PhD students has increased from 29.4% to 45.2% of all teaching at this level. Female students are in the majority in Behavioural Sciences, Biological Sciences and Other Sciences. Biological Sciences is the most popular discipline for female students to undertake a Science PhD. Biological Sciences represented 47.6% of teaching received by female students in 2002. Women's share of Mathematical Sciences, Physical/Materials Science and Earth Sciences is relatively low (at 26.6%, 27.6% and 34.4% respectively, but their presence in the Chemical Sciences has grown progressively, and was 41.9% in 2002.

Table 66: Student Load (EFTSU) by Discipline for Science PhD Students–Female Students

Subject Group						Growth 1989 - 2002	
Female Students - EFTSU	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Behavioural Science	3	12	24	31	33	31	1237.2%
Biological Sciences	463	698	1062	1158	1247	784	169.4%
Chemical Sciences	164	231	263	284	280	116	70.8%
Earth Sciences	48	91	120	202	216	168	350.4%
Mathematical Sciences	31	86	100	99	82	51	163.6%
Other Sciences	68	132	233	298	328	260	379.8%
Physical/Materials Sciences	39	7	117	133	141	103	264.4%
Information Technology	3	9	13	2	2	0	-9.7%
Other Discipline	48	128	205	308	288	240	504.9%
Total	**866**	**1464**	**2138**	**2515**	**2618**	**1752**	**202.3%**
Female Students - % of All							
Behavioural Science	40.0%	64.4%	61.3%	76.1%	67.9%		
Biological Sciences	41.1%	47.5%	49.7%	52.6%	53.2%		
Chemical Sciences	29.1%	33.2%	33.9%	39.7%	41.9%		
Earth Sciences	18.1%	20.3%	27.4%	33.8%	34.4%		
Mathematical Sciences	18.8%	23.0%	23.4%	29.4%	26.6%		
Other Sciences	29.1%	39.4%	42.0%	52.1%	50.8%		
Physical/Materials Sciences	9.8%	16.3%	21.2%	26.8%	27.6%		
Information Technology	15.9%	17.1%	25.6%	16.0%	19.6%		
Other Discipline	27.7%	39.9%	40.8%	45.1%	46.4%		
Total	**29.4%**	**35.0%**	**39.0%**	**44.5%**	**45.2%**		

Source: DEST Aggregated Data Sets

Overseas Science PhD Sstudents

Overseas students do not receive much of Science's PhD-level teaching, and it is rather less in proportionate terms now than it was in 1989 and 1993. The proportion has been static, at about 15% since 1997. Overall, growth has been modest.

Table 67: Student Load (EFTSU) by Discipline for Science PhD Students – Overseas Students

Subject Group						Growth 1989 - 2002	
Overseas Students - EFTSU	**1989**	**1993**	**1997**	**2001**	**2002**	**No.**	**%**
Behavioural Science	0	0	2	4	4	4	
Biological Sciences	229	227	307	293	316	87	38.2%
Chemical Sciences	106	115	96	105	103	-3	-2.9%
Earth Sciences	112	136	93	113	113	1	1.2%
Mathematical Sciences	31	72	74	71	60	29	92.6%
Other Sciences	93	73	90	95	114	21	22.6%
Physical/Materials Sciences	76	103	82	62	78	2	2.7%
Information Technology	4	9	6	1	2	-2	-52.1%
Other Discipline	33	54	91	113	103	70	208.1%
Total	**684**	**789**	**841**	**858**	**892**	**209**	**30.5%**
Overseas Students - % of All							
Behavioural Science	0.0%	0.0%	3.8%	9.9%	7.1%		
Biological Sciences	20.3%	15.5%	14.3%	13.3%	13.5%		
Chemical Sciences	18.8%	16.5%	12.4%	14.6%	15.4%		
Earth Sciences	42.4%	30.5%	21.2%	19.0%	18.1%		
Mathematical Sciences	18.8%	19.4%	17.2%	21.0%	19.5%		
Other Sciences	39.5%	21.7%	16.3%	16.7%	17.6%		
Physical/Materials Sciences	19.1%	21.7%	14.8%	12.6%	15.1%		
Information Technology	25.2%	17.6%	11.9%	10.8%	16.5%		
Other Discipline	19.5%	17.0%	18.1%	16.5%	16.6%		
Total	**23.2%**	**18.9%**	**15.3%**	**15.2%**	**15.4%**		

Source: DEST Aggregated Data Sets

9. Science Students and HECS

The Higher Education Contribution Scheme (HECS) was introduced in 1989. The White Paper (Dawkins, 1987) had stated that it would be difficult for the Commonwealth alone to provide for a significant expansion in higher education. HECS was therefore introduced as the mechanism by which participation in higher education could be increased. Under the scheme, virtually all domestic undergraduates were required to meet a portion of their tuition costs. When established, HECS was said to cover about 20% of the average course cost, and the 1989 fee was set at $1,800. Policy had it that HECS would rise only in line with increases in the Consumer Price Index, and by 1996 it had risen to about $2,500. In 1997, HECS was substantially changed. As well as increasing the base rate of HECS, it was no longer charged as an across the board fee, but rather it was to be charged in three bands, according to the discipline of the subject being taken. Subjects were placed in different bands based on a mix of the cost of teaching different disciplines, and the perceived economic benefit students would receive from undertaking some disciplines vis a vis other disciplines. Law, Medicine, Dental Science and Veterinary Science were all included in the most expensive HECS Band 3. The Science and Mathematics/ Computing Branches of Learning (and others) were placed in HECS Band 2.

There was concern at the time that charging above the minimum for Science/Mathematics might restrict student demand for Science. Although it is not possible to use higher education data to prove or disprove this assertion, it appears that there was little overall change in demand for university courses following the introduction of differential HECS. This was the position in 1997, the last year of statistics used in the analysis for *Trends*, and it was noted then that more years' data would be required to test hypotheses about course demand and HECS.

We now have more years' data (2001 and 2002 data having been added for this study), and demand for Science HAS declined, since its peak in 1997 in the years observed. Does HECS have anything to do with this? Given the range of variables involved, it is difficult to be definitive on this matter. A study by DEST staff has suggested that 'the introduction of HECS and its variants since that time, have not discouraged overall participation in higher education among persons from a low SES background. That said, the share of males from a low SES background in HECS Band 3 courses (the most expensive) declined appreciably, by 38%, following the introduction of differential HECS charges…future changes to HECS arrangements would need careful design to minimise their impact, particularly among groups more sensitive to student charges' (Aungles et al, 2002).

However, what is true is that teaching is the profession of choice or necessity for many Science graduates, and a first year Science teacher enters that profession with a much higher HECS debt than does an arts graduate. Could this factor reduce the attractiveness of teaching to Science graduates?

The Australian Academy of Science (2003, p9) believes this to be the case. Its *Recommendation 8* is 'That HECS-exempt scholarships be provided for commencing Science teacher education and a percentage of the HECS debt of Science and mathematics teachers forgiven for each year of teaching service'. At 2003 HECS rates, a Science graduate could owe nearly $19,000, comprising three years of Science (about $15,000 for the Science component, plus $3,680 for an Education year). An arts graduate might owe rather less: about $14,700 in total. These calculations presume that the Science student and arts student took only subjects in Band 2 and Band 1, respectively, during their undergraduate degree. Given the lack of salary differential between Science and humanities in teaching, perhaps it is unfair on Science graduates.

The Government's policy *Our Universities: Backing Australia's Future* (Nelson 2003) was released in May 2003. It proposes freeing up HECS by permitting universities to determine the level of HECS they charge, allowing increases of up to 30% above current levels, from 2005. Some universities have already announced that they will indeed charge this 30% premium, and it has been suggested that the capacity to charge higher HECS fees will be a de facto 'quality' indicator. Universities will also be permitted to forego HECS, but it seems unlikely that many will actually reduce HECS from its current levels. The policy has also proposed the creation of an additional HECS band, equivalent to the current Band 1. This is the so-called National Priorities band, for education and nursing (Nelson, 2003, p22).

The Australian Labor Party released its policy for education on 23 July 2003. The key policy so far as Science and HECS is concerned relates to lower fees for mathematics and Science students: 'Labor believes that areas of national skills shortage – like mathematics and Science – should be in the lowest HECS band to encourage more students to pursue these fields' (Crean & Macklin, 2003 p16).

Table 68 is based on an analysis of 2002 HECS Liability data. The table shows that Science students (Bachelor and Bachelor (~~Hons.~~Hons) only) were enrolled in Science subjects to the extent of 24,952 EFTSU, comprising 19,713 (or 79%) of EFTSU for which students had deferred their liability, and 5,239 (21%) EFTSU for which students had paid HECS up front, for which they received a 25% discount. About 1% of the total EFTSU was for students who had paid up front, but were not eligible for a discount. With this 79%/21% split, Science subjects in Band 2 would generate $124 million in fees. Had these subjects been HECS levied at the Band 1 rate, $87 million would have been generated, meaning that Science students would accrue about $37 million less of HECS liability. However, Science students are not the only students undertaking Science subjects. If all students taking Science subjects were levied at Band 1 rates, about $80 million less would be owed by students.

Table 68: Student Load (EFTSU) in Science Subjects, 2002 - Bachelor & Bachelor (Hons) Students, Science and All Fields of Education

	HECS	Science Students			All Students		
		Deferred	Up Front	Total	Deferred	Up Front	Total
EFTSU		19713	5239	24952	42247	11958	54205
	$	$'000	$'000	$'000	$'000	$'000	$'000
HECS 2003 (Band 2)	5242	103335	20597	123932	221458	47013	268472
HECS 2003 (Band 1)	3680	72543	14460	87003	155469	33004	188473
Difference	-1562	-30792	-6137	-36929	-65990	-14009	-79999
2005 Est'd HECS (Band 2)	5490	108224	21572	129795	425238	193466	618705
Liberal Policy: (+30%)	7137	140691	28043	168734	301516	251506	553023
Liberal Policy: (+20%)	6588	129868	25886	155754	278323	232159	510482
Liberal Policy: (+10%)	6039	119046	23729	142775	255129	212813	467942
Difference (+30%)	1647	32467	6471	38939	123722	58040	65682
Difference (+20%)	1098	21645	4314	25959	146916	38693	108222
Difference (+10%)	549	10822	2157	12980	170109	19347	150763
Labor Policy HECS 2005 (Band 1)	3854	75973	15143	91117	162820	34565	197385
Difference	-1636	-32250	-6428	-38679	-69116	-14673	-83789

Source: DEST Aggregated Data Sets; Nelson (2003) Crean & Macklin (2003)

As noted above, both major political parties have recently released policies on their vision for higher education in the future. In the Liberal policy, universities would be permitted to charge up to a 30% premium on the estimates of HECS in 2005. Assuming the same levels of student load in 2005, a 30% increase applied sector-wide would lead to HECS generating an additional $39 million more than HECS levied at the 'standard' Band 2 level for Science students. This is an unlikely scenario. The table also shows the effects of a sector-wide 20% increase, and a 10% increase. These scenarios would generate an additional $26 million and $13 million respectively of HECS debt for domestic students in Science bachelor and bachelor (~~hons.~~Hons) courses.

The Labor policy would eventually save domestic students in Science bachelor and bachelor (~~hons.~~Hons) courses about $39 million at 2005 prices, and all students taking Science subjects about $84 million. In the short term, if a future Labor Government were to implement this policy, they would need to find just over $14 million from government coffers, to meet the reduced HECS paid by students meeting their HECS liability up front in 2005. This figure concurs with Labor's own calculation (Crean & Macklin, p25).

10. Science and Mathematics at School

Material in earlier sections of this study highlighted the relative decline in Science, and in particular the declining engagement with the enabling sciences. Is this decline at university merely an extension of a decline of Science at school? Work undertaken for *Trends* noted that between 1989 and 1997 there were 4,218 fewer enrolments in the Science KLA. In the same period, Mathematics increased by 21,690 enrolments, and Technology by 32,972. However, as noted in *Trends*, the simplistic and variant methodologies adopted by different states and territories made it difficult to assess the real level of change.

The participation of students in Year 12 Science and Mathematics is an issue relating to the relative 'popularity' of Science and mathematics vis a vis other Year 12 subjects, but also to the stock of school aged people, and their propensity to continue to Year 12.

Age Participation and Apparent Retention Rates

Two main factors influence the numbers of students in Year 12 at school. One is the number of young people of appropriate age in the population as a whole, and the other is the apparent retention of students to Year 12. Table 69 shows the numbers of persons aged 15 to 19 in the Australian population, in 1986, 1991, 1996 and 2001.

Table 69 Estimated Residential Population aged 15 to 19 years '000s

Year	Males	Females	Total
1986	690.6	660.6	1351.2
1991	700.1	666.1	1366.2
1996	655.3	623.8	1279.1
2001	677.3	647.9	1325.3

Source: 1986 BIR Trends and Prospects; 1991 Estimated Residential Population; 1996 Australian Demographic Statistics; 2001 ABS Basic Community Profile Table B 03

As can be seen, the student aged population increased between 1986 and 1991, declined to 1996, but at the time of the 2001 Census of Population and Housing had increased. The drop in the number of school aged persons since 1986 provides an explanation for the drop in enrolments at secondary school. There are many more males than females in the 15-19 year age cohort, but as is shown below, there are more girls than boys enrolled in Year 12.

The Apparent Retention Rate is the proportion of students of a given cohort which continue to a particular year of education. The Australian Bureau of Statistics (ABS) calculates the retention rate for full time students who continue to Year 12. The collection of information on Apparent Retention Rates to Year 12 goes back to 1967, when the rates were 26.5%, 18.7% and 22.7% respectively for boys, girls and overall. Since then there has been a marked increase in retention levels in secondary education in Australia. Table 70 shows the Apparent Retention Rates from Year 10 to 12, by sex. The considerable retention gap between male and female students should be noted.

Table 70 Apparent Retention Rates from Year 10 to Year 12 - 1995 - 2000

Year	Full-time males %	Full-time females %	Full-time students %
1995	68.4	78.7	73.4
1996	68.6	78.7	73.6
1997	69.3	79.9	74.5
1998	68.9	79.4	74.1
1999	68.9	79.9	74.4
2000	69.0	80.0	74.4
2001	70.8	80.1	75.4
2002	72.4	81.7	77.0

Source: 2000-2002 Schools 2002, Australia (4221.0); 1995-1999 ABS via Dobson & Calderon 1999.

There are other variables in Apparent Retention Rates, such state/territory, and type of school. The ACT and Victoria have higher rates than other states and territories, and retention is considerably higher at non-government schools (Guy, 2003). Apparent Retention Rates in different states/territories are dependent upon local conditions. These conditions are dictated by the economic environment, labour market opportunities and the political agendas under which each secondary school system operates. Retention rates fluctuate despite initiatives from state/territory governments to encourage students to remain at school until completion of Year 12.

School Statistics

Under Australia's constitution, eSecondary education is one of the responsibilities of state and territory governments, but whereas the Commonwealth assumed the majority financial responsibility for higher education many years ago, secondary education remains predominantly a state government responsibility.. Australia has a single higher education system, but eight different secondary school systems. The absence of common nomenclature and reporting standards does nothing to facilitate comparisons between states/territories. Statutory boards in each state/territory are responsible for the composition and structure of Year 12, and they oversee the development and accreditation of courses of study, assessment and the issuing of qualifications.

DEST has overall responsibility for gathering information from the various state/territory authorities, via its Schools Group, operating through several state and territory authorities. The Schools Group was the source of the statistics Year 12 subject enrolment statistics in this chapter.

The Department of Education, Training and Youth Affairs (DETYA) via its School Division has overall responsibility for gathering information from the various state and territory authorities. The School Division maintains a school database which provides the information reported in the *National Report on Schooling in Australia* (Ministerial Council on Education, Employment, Training and Youth Affairs).

The analysis of school enrolments undertaken for this study relate to subject enrolments in Key Learning Areas, and particular in Science and Mathematics. The adequacy of such data depends on the reliability of the information maintained centrally, and how they they are aggregated.

. However, there are discrepancies in published figures between the total number of enrolments for the Science KLA, and the total number obtained by aggregating all enrolments by Science subjects.

The analysis of subject enrolments is based on raw counts of students enrolled in subjects. However, this presents a potential problem, which can be explained by a brief comparison of school statistics with higher education statistics. In higher education, university subjects are 'weighted', according to the proportion of a full time student's workload represented by each subject. Under the university methodology, a university student enrolled in a normal full time course year is defined as one 'equivalent full time student unit'. in If the normal year's work in a course comprised four subjects of equal- 'size', 'size' each would will generate 25% of the student's 'student load' for each of those subjects. A part time student, doing only two of those subjects would generate 0.5 'equivalent full time student unit'. Another student enrolled in five subjects of equal weight in satisfaction of a normal full time work load in a different course would generate only 20% of her/his 'load' in each of those subjects.

The school system is rather less systematic in the way it reports. By reporting raw counts of school subjects which have not been weighted, apparent subject enrolments can artificially

increase for instance, if a subject offered in one calendar year is split into two subjects offered in the next. Secondary school data could certainly be greatly improved by ~~a consideration of also~~moving to a system in which enrolments are reported in 'equivalent full time' terms. Nothing would be lost, but much could be gained by doing so, and data collected from different states/territories would be available for comparison and aggregation into obvious and meaningful national figures.

The successful completion of Year 12 or otherwise shapes students' immediate access to further education at university, or access to training programs or to employment. The range of subjects students undertake in the final two years of secondary school often dictates the pathways available to them.

Enrolments by Key Learning Area

'Key Learning Areas' (KLAs) are groupings of subjects within broad categories. The use of the Key Learning Area structure was established a number of years ago within the context of Australia's common and agreed national goals for schooling. Since then each state and territory has worked on programs to develop curriculum statements and profiles for each learning area. For the school years 7 to 12, eight KLAs have been established:

- *Creative and Performing Arts;*
- *English;*
- *Health and Physical Education*, which includes subjects such as personal development;
- *Languages Other Than English;*
- *Mathematics;*
- *Science*, which covers the subject areas in p~~of P~~hysical ~~Sciences ,and~~ b~~B~~iological and ~~Other~~ other ~~Sciences~~sciences, and from 1991, psychology;
- *Society and Environment*, which covers the subject areas of Humanities and Social Sciences and Economics and Business; and
- *Technology*, which covers the subject areas of Computer Studies, Home Science, Technical Studies and Agriculture.

In 1986, there were 128,112 students enrolled in Year 12, and they generated 598,327 subject enrolments in tertiary-accredited subjects. By 1997, there were 172,772 students, generating 868,037 enrolments, and 900,776 subject enrolments in 2002. This meant that during that period there was an increase of 51% in the student population and an increase of 57% in the total number of subject enrolments. The uncertainty inherent in analysing subject enrolment data should again be emphasised.

The foci of this study are Science and Mathematics, but subject enrolments in other KLAs are considered first, for purposes of completeness and comparison.

Table 71 summarises subject enrolments from 1986 to 2002.

Table 71 Subject Enrolments by Key Learning Area 1986 - 2002

KLA	1986	1987	1997	1998	1999	2000	2001	2002
English	114650	123977	168273	164328	167381	170544	180276	182758
Mathematics	104199	112914	156903	152794	155722	162488	171185	173330
Society & Environment	165824	188298	196294	187340	191195	202180	191533	194303
Science	129507	136977	150223	143326	144342	146602	143585	142923
Arts	28941	32532	61391	60944	63980	69653	73276	75322
LOTE*	15966	18122	24781	23808	24051	24562	26102	26143
Technology	28861	31126	71629	70643	73925	84764	96367	96797
Health & Physical Ed.	8532	10069	38543	37120	37596	39983	45142	47832

TOTAL	598327	655491	868037	840303	858192	900776	927466	939408
% Mathematics	17.4%	17.2%	18.1%	18.2%	18.1%	18.0%	18.5%	18.5%
% Science	21.6%	20.9%	17.3%	17.1%	16.8%	16.3%	15.5%	15.2%
Year 12 Enrolments	128112	142107	172772	177234	182498	185819	188110	193672

Source: DEST Schools Group; ABS Schools 4221.0

On the basis of these figures, most KLAs have increased in size over the past 15 years, but Society & Environment and Science had fewer enrolments in 2002 than they had in earlier years. In the case of Science, on the basis of subject enrolments, it was smaller by several thousand enrolments in 2002 compared with 1997.

Key Learning Areas - Mathematics & Science[2]

Data analysed for this section of the report were obtained from the Schools Group, DEST, and the focus was on tertiary accredited subjects or studies accepted for entrance to tertiary education. The aim was to analyse the information from a national perspective, rather than on the basis of individual states/territories.

Official concern about participation in Science, Mathematics and Technology was expressed in the Dawkins White Paper (1988): 'Achieving improved rates of transfer to technology-based courses in particular will require increased participation in mathematics and Science at the secondary level. The Government is concerned that the proportion of Year 12 students, particularly girls, currently taking such subjects remains low' (Dawkins, 1988: 17).

- **Mathematics Key Learning Area**

The number of Year 12 enrolments in the key learning area of Mathematics increased from 104,199 in 1986 to 173,330 in 2002.

The names of subjects in the Mathematics KLA do not provide any indication of their content, in contrast with subject areas in the Science KLA. For example, the subject options in Queensland are Mathematics A, Mathematics B and Mathematics C, whilst in Victoria they are Further Mathematics, Mathematical Methods and Specialist Mathematics. Curriculum changes and variations between states and territories make the distinction between '*hard*' and '*soft*' Mathematics more difficult to define.

- **Science Key Learning Area**

Table 71 above showed that the number of enrolments in Science increased by 16%, from 129,507 in 1986 to 150,223 in 1997, but declined continuously to 142,923 in 2002.

[2] *Trends* noted two significant studies which examined the overall trends in Year 12 Science enrolments in secondary school in Australia. Dow (1971) examined science enrolments for the period between 1960 to 1969. In 1986 Dekkers, De Laeter and Malone analysed Science and Mathematics enrolments for the period between 1970 and 1985. They updated their report in 1991 to include data up to 1989. The main source of information for these reports was the respective educational authority in every state and territory. These authors have subsequently published other research on this topic. More recently still, DEST's Review *Australia's Teachers: Australia's Future – Advancing Innovation, Science, Technology and Mathematics* , released mid-October 2003, provided even more analysis of trends.

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Year 12 Science Enrolments

There are data discrepancies between KLA based data from the National Report on Schooling in Australia on the one hand and DETYA's Schools Division data on the other for years 1992 to 1995. For the years 1991, 1996 and 1997, published figures matched. The table below illustrates this point.

Table
Number of Student Enrolments for the combined Science KLA by Year

Year	*National Report on Schooling **	*Schools Division DETYA #*	*Difference*
1991	164,926	164,926	Nil
1992	181,331	174,681	6,650
1993	172,797	164,731	8,066
1994	153,631	143,619	10,012
1995	147,150	136,741	10,409
1996	146,658	146,658	Nil
1997	150,223	150,223	Nil

Source: * National Report on Schooling in Australia, various years.
Schools Division, DETYA.

##########

Drilling Down: Science in More Detail

Table ~~6~~ 72 examines the subject streams within the Science KLA in more detail. With the exception of Psychology, there were many fewer subject enrolments in 2002 than there had been in 1992, the numerical high point. The assumption made here is that the distribution of subject enrolments in 1992 was the same as in other years. Did students enrol in more subjects in satisfaction of a Year 12 than subsequently?

As another indicator of the absence of 'system', it needs to be pointed out that the apparent increase between 1996 and 1997 is almost certainly illusory. It was noted in *Trends* that Science subject enrolments in that territory increased from 3,332 to 6,516 (Dobson & Calderon 1999, Appendix 2, ACT). Statistics received recently from DEST indicate that the number declined to a more typical 3,405 subject enrolments in 1998. However, current DEST statistics continue to show this aberration in 1997, which saw anomalous increases of 955 in Biology, about 1740 in Physics and 70 in Geology. These increases represented three-fold growth in Physics, and a doubling in Chemistry and Geology.

Table ~~6~~ 72 Science Enrolments by Subject Stream 1992 - 2002

	1992	1994	1996	1997	1998	1999	2000	2001	2002
Number									
Biology	68428	55673	52229	52835	50948	51819	52369	49453	49605
Chemistry	43594	36894	35466	35821	34225	34259	35130	33554	33105
Geology	2474	1624	1164	1046	992	1000	945	1910	1834
Physics	40464	32595	31769	33911	31180	31128	31372	31629	31128
Psychology	9462	11257	11922	13082	13001	13446	13828	14670	15037
Science - Other	15832	15476	14108	13528	12980	12690	12958	12369	12214
Total	**181331**	**153631**	**146658**	**150223**	**143326**	**144342**	**146602**	**143585**	**142923**
Per Cent									
Biology	37.7%	36.2%	35.6%	35.2%	35.5%	35.9%	35.7%	34.4%	34.7%
Chemistry	24.0%	24.0%	24.2%	23.8%	23.9%	23.7%	24.0%	23.4%	23.2%
Geology	1.4%	1.1%	0.8%	0.7%	0.7%	0.7%	0.6%	1.3%	1.3%
Physics	22.3%	21.2%	21.7%	22.6%	21.8%	21.6%	21.4%	22.0%	21.8%
Psychology	5.2%	7.3%	8.1%	8.7%	9.1%	9.3%	9.4%	10.2%	10.5%
Science - Other	8.7%	10.1%	9.6%	9.0%	9.1%	8.8%	8.8%	8.6%	8.5%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Change									
Biology		-12755	-3444	606	-1887	871	550	-2916	152
Chemistry		-6700	-1428	355	-1596	34	871	-1576	-449
Geology		-850	-460	-118	-54	8	-55	965	-76
Physics		-7869	-826	2142	-2731	-52	244	257	-501
Psychology		1795	665	1160	-81	445	382	842	367
Science - Other		-356	-1368	-580	-548	-290	268	-589	-155
Total		-27700	-6973	3565	-6897	1016	2260	-3017	-662

Source: DEST Schools Group

Comparing 1992 with 2002, it can be seen that the distribution within Science has changed over time. While Psychology as increased its share of Science enrolments, from 5.2% to 10.5%, Biology, Chemistry and Physics have each decreased their share (by respectively 3.0%, 0.8% and 0.5%).

These patterns are also demonstrated in Figure 13, which shows the four largest groupings within the Science KLA.

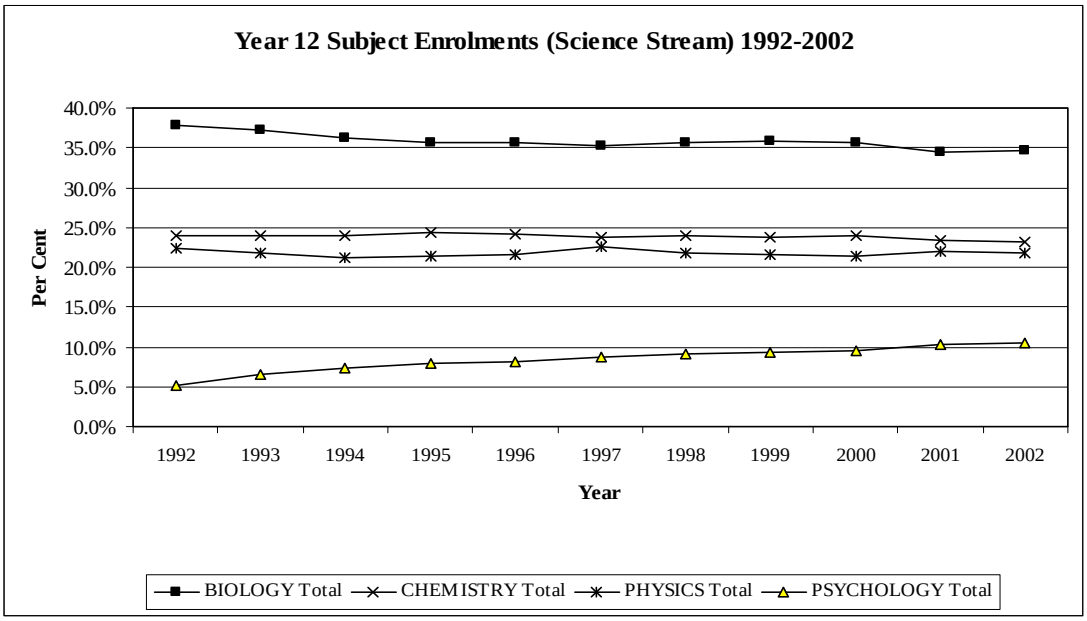

Figure 13 Year 12 Subject Enrolments 1992- 2002

Science subject enrolment patterns are different in different States/Territories, and are summarised in Table 73.

Table ~~6~~ 73 Science Enrolments by State/Territory 1992 - 2002

	1992	1994	1996	1997	1998	1999	2000	2001	2002
Number									
ACT	4238	3887	3332	6516	3405	3218	3160	3019	3027
New South Wales	54414	46934	42926	40591	39916	40036	38965	37670	36352
Northern Territory	855	765	839	696	624	700	670	673	659
Queensland	39324	31941	34252	35254	33179	34394	38501	36874	37028
South Australia	14521	11774	9832	10227	10023	9870	9707	9415	8818
Tasmania	4276	3026	1877	2674	2799	2735	2525	2823	2712
Victoria	44738	38558	38857	39873	38828	39102	38845	39336	40458
Western Australia	18965	16746	14743	14392	14552	14287	14229	13775	13869
Australia	181331	153631	146658	150223	143326	144342	146602	143585	142923
Change over Previous Year									
ACT		-351	-555	3184	-3111	-187	-58	-141	8
New South Wales		-7480	-4008	-2335	-675	120	-1071	-1295	-1318

Northern Territory	-90	74	-143	-72	76	-30	3	-14
Queensland	-7383	2311	1002	-2075	1215	4107	-1627	154
South Australia	-2747	-1942	395	-204	-153	-163	-292	-597
Tasmania	-1250	-1149	797	125	-64	-210	298	-111
Victoria	-6180	299	1016	-1045	274	-257	491	1122
Western Australia	-2219	-2003	-351	160	-265	-58	-454	94
Australia	-27700	-6973	3565	-6897	1016	2260	-3017	-662

Source: DETYA Schools Division.

Figures for the ACT are clearly out of line with those in the rest of the country, with an apparent increase of 54% in Science enrolments between 1992 and 1997, and a subsequent decline of 115% between 1997 and 2002. Table 71 is a summary which records all Year 12 Science subject enrolments by state/territory from 1992 to 2002. Despite these difficulties, Table 73 suggests a fairly general decline in Science subject enrolments between 1992 and 2002 in all states and territories, ranging from a low of –9.6% in Victoria, to –39.3% in South Australia.

What have ~~all~~ the statistics in this section told us? One thing is that t~~ In the first instance, t~~hey show that it is difficult to undertake consistent analysis of school statistics. The apparent lack of a national approach to data collection and reporting means that it is virtually impossible to measure preference changes at school during the last decade. ~~No doubt this~~This might explain~~s~~ the relative dearth of published research on schools at a national level. No doubt there are experts within each state/territory jurisdiction, but few able to compare data across states/territories.

So far as Science is concerned, these statistics suggest a decline in senior school Science, which must go at least part of the way to explaining the decline in the fortunes of university Science. In the case of Mathematics, there has been an increase in Year 12 enrolments. However, it is possible that that growth has come about by students enrolling in terminal mathematics subjects, successful completion of which would not prepare them for university mathematics**.**

11. Conclusion

Science at the Crossroads, one regrets to say, shows that the previously noted decline in Science between 1989 and 1997 has continued into the new century. The downward trend in the teaching of many areas of traditional Science has now been with us for over a decade. In terms of the years selected for this study, 1993 was the zenith for Chemistry, Earth Sciences, Mathematics and Pysics. Behavioural and Biological Sciences have grown considerably, but both at rates below the system-wide pattern of growth (Table 6, above). Perhaps Information Technology had become the saviour for deans of Science faculties, but the labour market downturn has had a knock-on effect in Information Technology course enrolments (Table 25).

Looking more narrowly at students enrolled in Science courses, Table 52 showed that apart from the biological sciences, the greatest growth has been in non-Science/non-Information Technology subject disciplines. The proportion of non-Science/non-Information Technology student load in Science students' working year has increased from 16.7% in 1989, to 25.6% in 2002, having risen both absolutely and proportionately in each year of observation. For Science students, their overall interest in mathematics and physics has been in decline since 1993, and in earth sciences and chemistry, the rot set in 1997. Science students' engagement with the behavioural sciences has also dropped since 1997, but on the basis of 2001/2002 figures, perhaps it is growing again. Biological Science and Other Sciences both had their best year in 2002.

Declines in 'hard' Science at university are strongly correlated with what has happened and is still happening in secondary education. Analysis of Year 12 subject enrolments in Science indicate that the decline noted in *Trends* have continued.

Although education (all levels) is a State/Territory responsibility under the Australian Constitution, only at the university level is there any consistency in reporting. TAFE data and secondary school data lack a consistent national system for data reporting, and it is extremely difficult to compare and contrast patterns in individual states. Where data are available, the absence of a measure equivalent to 'student load' means that comparisons within and between institutions are difficult to make. Likewise it is difficult to obtain university entrance data from across the states. Some university entry authorities publish useful and useable information, but it is difficult to use these data to make comparisons between states.

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Data Sources

Statistical data were obtained from two Groups within the Department of Education, Science and Training: the Higher Education Group, and the Schools Group, and from the Australian Bureau of Statistics. Tabulations on university enrolments and student load were created using customised aggregated data sets. Statistical material on Course Completions was obtained from standard aggregated set 'UPAG' for the years in question.

Appendix 1: Higher Education Statistics – How do they work?[3]

The Commonwealth Tertiary Education Commission (CTEC) introduced a uniform data collection methodology in the late 1980s for both halves of the then binary system of higher education. Universities are required to use this methodology to supply information to the government by way of several series of unit record files. The system has been amended, and the collection software upgraded several times since the first collections were taken. CTEC was decommissioned in the late 1980s, and elements of its role absorbed into the (then) Department of Employment, Education and Training. Data collection is compulsory, and is supported by provisions in the Higher Education Funding Act (HEFA).

The higher education system's data integrity relies on universities adhering strictly to the definitions contained in a data element dictionary, which provides assistance in understanding the scope of what has to be collected. Data elements defined for the student collection include matters relating to the students themselves, such as sex, date of birth, permanent and semester residence information (collected in the form of postcodes or overseas country codes), previous scholastic background information, and background information on country of birth, year of arrival in Australia, language spoken at Home, and/or Indigeneity. This information is provided to universities by students at time of enrolment. Another set of information on students is generated by universities: students' basis of admission, enrolment type (full time, part time or external), and their liability for, or exemption from paying Higher Education Contribution Scheme (HECS) fees. Researchers can derive additional information from the material universities supply, for instance, by linking postcodes into indicators of location (Rural, Isolated or Urban), and socioeconomic status (High, Middle or Low). These latter two pieces of information are derived by using the Australian Bureau of Statistics' 'EdOcc' Index, which is based on information collected in the quinquennial Census of Population & Housing.

Still more information is provided by universities on the level, duration and name of the courses they offer, the subjects taught in those courses, and the teaching departments which teach those subjects. Universities link their courses to Fields of Education (from 2001; to Fields of Study in earlier years), their subjects to Fields of Education (from 2001; to Discipline Groups in earlier years), and their teaching departments to Academic Organisational Units (AOUs). Aggregated files of higher education data provide the opportunity for analysts to permutate and combine the various data elements to describe many aspects of the student body.

Changes to the scope of a data collection present difficulties for the analyst. Two fundamental changes have occurred since *Trends* was written in 1999.

The first change relates to the scope of counting enrolments used by DEST. In a sense, there are three ways students might be counted in 2002, two of which are used by DEST in its published statistics.
The 'whole of year' approach as applied to 2002 statistics counts students enrolled at any time between 1 September 2001 and 31 August 2002, and student load generated by them over this period. This methodology produces a 2002 enrolment total of about 896,000.
The 'first half of year' approach as applied to 2002 statistics counts students enrolled at any time between 1 September 2001 and 31 march 2002, and student load generated by them over this period. This methodology produces a 2002 enrolment total of about 795,000.

[3] NOTE: This is a more thorough explanation of material presented in the section *Higher Education Statistics* (p3). Some of the text in this Appendix is repeated from that section.

To use either of these total enrolment figures would mean that it was impossible to observe enrolment changes over time consistently. Therefore, the original methodology was used for this study. The original methodology produced an enrolment for 2002 of just under 751,000. It is this figure which would permit time series analysis to match figures in tables produced for *Trends* and the DEST statistical publications produced up until 2001. For a study such as this, where one of the key issues is change over time, it was important to retain the original census-based methodology. In future, comparisons over time, which include years prior to 2001 will be very much more difficult.

In future, comparisons over time will be very much more difficult, if they are to include years prior to 2001. Only with great effort will students and researchers be able to plot comparative change in the higher education sector.

The second change relates to the classification of courses and subjects. In summary, before 2001, courses were coded to a Field of Study classification, and subjects to a Discipline Group classification. From 2001, both courses and subjects are coded to a single Field of Education classification. The changes which occurred from 2001 are discussed in detail below.

The terms 'course' and 'subject' are used in this study, and it is important that readers understand how these are defined.

Definition of 'Course'

For purposes of providing certain statistical information, universities are required to link the courses they teach into generic categories, called variously "Fields of Study" (until 2001), and "Fields of Education" (since 2001), based on the likeness of the content and vocational orientation of those courses. Most analysis and reporting of the distribution of enrolments in courses is done according to *Broad* Fields of Study, or *Broad* Fields of Education, which are aggregations to the first two digits of the respective classifications.

A 'course' can be an award course, a non-award course, an enabling course, or a cross-institution program undertaken at a higher education institution. An award course is a program of study formally approved/accredited by the institution or any other relevant accreditation authority and which leads to an academic award granted by the institution or which qualifies a student to enter a course at a level higher than a bachelor's degree. Examples of 'courses' are BSc, MSc or PhD, but actual usage is dependent on universities. For example,

University A might offer a single BSc into which it enrols all students progressing towards meeting the university's regulations for the award. The students enrolled in the BSc could be undertaking a range of subjects of prescribed levels in order to meet university regulations. One student might therefore specialise in mathematics and statistics, and another in chemistry. This was the norm at 'traditional' universities pre-Dawkins.

University B, on the other hand, might use 'course' in a rather more specific way, and could therefore offer a wide range of undergraduate Science degrees which are separately defined to reflect the student's specialisations: BSc (Mathematics), BSc (Chemistry), BSc (Earth Sciences), and so on. Whereas University A would report ALL of its BSc students as being in a course identified by a single code, University B would report its Science students in courses identified by a range of unique codes.

Another variation in university reporting can arise from a situation in which some universities provide 'course' information in their annual reporting to DEST which concatenates a 'course', such as BSc with additional 'stream' or 'major' information which provides more

specific advice as to what students are actually undertaking. Universities following this procedure might therefore have linked BSc students taking say, a Physics major to a 'course' identified by Field of Study '090505 Physics' (or Field of Education '010301 Physics' under the new classification). These factors all lead to a situation which means that longitudinal 'course' information cannot be reliably plotted below the 'Broad Field of Study/Education' level, the first two digits of the respective classification. To establish changes in what Science students are actually studying therefore requires an examination of changes over time in the subjects they take as part of their degrees. So far as courses are concerned, fine detail in classification is more relevant and helpful when analysing postgraduate enrolments patterns.

It was noted in *Trends* that despite the apparent wide range of options available for Science courses in these classifications, it needs to be noted that many university courses, particularly at the undergraduate level, are generalist degrees, such as the BSc. Although things have changed considerably in the post-Dawkins Reforms years, in the past many 'traditional' universities offered only a limited number of courses, and the practice of having a large number of 'courses' was more prevalent in the pre-Dawkins college sector. In fact, many universities have offered specifically branded computer Science degrees for only a few years. Therefore, in recent years most universities have expanded the apparent range of courses offered, without any fundamental increase in the range of subject options available to their students.

Definition of 'Subject'

Students enrol in subjects as components of their university courses. These subjects are 'weighted' according to the proportion each represents of a year's work. For instance, in the case of a university course for which a year's work comprises four subjects of equal size, each subject would be weighted at '0.250', a full year's load in a standard course being defined as '1.000' Equivalent Full Time Student Unit (EFTSU). These 'subject weights' are critical for a number of reasons, but not the least because they provide the basis for meeting DEST targets and university funding, and for the calculation of students' liability to pay the Higher Education Contribution Scheme (HECS) (for any student not exempted from the payment of HECS).

As was the case for 'courses', universities might use different terminology. For example,

University A might enrol its students in 'subjects' such as Chemistry 1a, Mathematics 3 or Physics 4 (~~Hons.~~Hons).

University B might use the term 'unit' rather than 'subject' to describe an arrangement which is otherwise identical to University A's.

University C might organize its affairs differently, for example by enrolling its BSc students in a 'subject' First Year Chemistry, which comprises two units, Organic Chemistry and Inorganic Chemistry. These variations of usage are reflections of administrative arrangements within universities.

Subjects with a likeness in terms of their subject matter are classified and reported by universities according to generic categories. Prior to 2001, subjects were linked to Discipline Groups which were aggregated into 11 Branches of Learning. Since 2001, subjects have been classified into 'Fields of Education', using the same classification as the one used for courses.

Analysis in this report focuses on the Discipline Groups/Fields of Education from the Science and Information Technology areas, plus Behavioural Sciences, which is a discipline categorised within what is now described as Field of Education *09 Society and Culture*.

Subjects are coded to discipline groups/ fields of education without regard to the type of department (Academic Organizational Unit, or AOU) responsible for the subject being taught. For example, a subject "mathematics for engineers" might be taught by an Engineering AOU and a subject "pure mathematics" by a Mathematics AOU. Nonetheless, both subjects should correctly be coded to the Mathematics Discipline Group (pre 2001) or Field of Education (2001+). Were the subject "mathematics for engineers" to be taught by the Mathematics AOU, or the "pure mathematics" subject by the Engineering AOU, both would still be coded to a Discipline Group/Field of Education related to "Mathematics".

Classification of Course Completions

Another annual requirement is the provision by universities of a student-by-student 'Past Course Completions' file. Until 2001, Course Completions were also reported according to the Field of Study classification, and since 2001, according to the Field of Education classification.

A Note on Temporal Consistency

In addition to the fundamental changes mentioned already, there have been other changes over the years which affect temporal consistency.

Combined course enrolments. Prior to 1997, the Commonwealth Government enrolment collection methodology allowed for each course to be linked to a single field of study only. (It is now possible to allocate two fields of study to a course). For instance, published figures for 1997 indicate 103,701 enrolments in Broad Field of Study Science, an increase of almost 12,000 over the figure reported for 1996 (91,986). Counting Science enrolments in 1997 according to the pre-1997 methodology generates 95,861 enrolments, so although the number of Science students increased between 1996 and 1997, the increase was fewer than 4,000, not nearly 12,000 suggested by the figures. It is not possible to amend pre-1997 figures in this instance, as only one field of study was linked to each course.

Course Levels/ new Course Levels. 'Bachelor's postgraduate' is a term formerly used to describe bachelor-level courses which nonetheless had a minimum entry requirement of a bachelor degree. Until 1994, these courses were routinely linked to the 'Other Postgraduate' group of courses. Since that time, which coincided with a change in funding arrangements, they were redesignated 'bachelor's graduate entry' and reported along with undergraduate bachelor enrolment statistics. In this study, students enrolled in these courses are reported as 'bachelor' in all years. This is not really an issue, as typically there have been few enrolments for Science at this level. The course level 'doctorate by coursework' was first reported in 1994. Prior to that, all higher doctorates were reported as 'research'. In 2001 and 2002, no Science enrolments were reported by universities as 'doctorate by research'

Overseas Students. From time to time, DEST has changed the definition of 'overseas student'. DEST Data Element Dictionaries have had a consistent definition, but their own publications have not always reported statistics according to that definition. (From time to time, New Zealand citizens have been included as 'overseas' students). In this study, the current definition of 'overseas student' has been used throughout, and it is the one now reported in DEST publications, and New Zealanders are NOT counted as overseas students.

Appendix 2 provides a glossary of terms used in the report. Many of these have been taken verbatim from DEST's Data Element Dictionary.

Course/Subject Classification Changes from 2001

A new system of classification of university courses and subjects was instituted from 2001. It reflected the change from the 'Field of Study Classification of Higher Education Courses' (FOSCHEC), and Branches of Learning/Discipline classifications to the 'Australian Standard Classification of Education' (ASCED Fields of Education).

Courses

Until 2001, universities classified and reported their courses by linking them to a six-digit Field of Study (FoS). In this classification, the first two digits identified the Broad FoS. Digits three and four identified a subset Major FoS, and the last two digits the Minor FoS. From 2001, the FoS classification was changed to Field of Education (FoE).

Figure A shows old and new classifications for courses:

Figure A
Fields of Study and Fields of Education (Top Level)

Broad Fields of Study (FoS) Pre 2001	**Broad Fields of Education (FoE) 2001 +**
01 Agriculture/Animal Husbandry	01 Natural & Physical Sciences
02Architecture/Building	02Information Technology
03Arts/Humanities/Social Studies	03Engineering & Related Technologies
04Business/Administration/Economics	04Architecture/Building
05Education	05Agriculture/Environmental& Related Studies
06Engineering/Surveying	06 Health
07 Health	07Education
08Law/Legal Studies	08Management & Commerce
09Science	09Society & Culture
10Veterinary Science	10Creative Arts
	11Food/Hospitality/Personal Services
	12Mixed Field Programs

Source: Pre 2001: CTEC Field of Study Classification of Higher Education Courses. AGPS, April 1986: 6.
2001+ : ABS Appendices 6 & 7 Obtained in August 2003 from http://www.abs.gov.au

A full list of correspondence between Fields of StudyDiscipline Groups and Fields of Education appear at the end of this Appendix.

At the top level, the principal unambiguous changes and mapping between the two classifications are as follows:

Most of FoS *01 Agriculture & Animal Husbandry* has become *FoE 05 Agriculture & Environmental Studies*;
FoS *02 Architecture & Building* has become FoE *04 Architecture & Building;*
FoS *03 Arts, Humanities & Social Studies* has become either FoE *09 Society & Culture* or FoE *10 Creative Arts*;
FoS *04 Business, Administration & Economics*: Business & Administration now form FoE *08 Management and Commerce*, but Economics has become a subset of FoE *09 Society & Culture;*
Most of FoS *05 Education* has become FoE *07 Education*;
FoS *06 Engineering & Surveying* has become FoE *03 Engineering & Related Technologies;*
Most of FoS *07 Health* has become FoE *06 Health;*
FoS *08 Law & Legal Studies* is now part of FoE *09 Society & Culture;*
FoS *10 Veterinary Science* has become a subset of FoE *06 Health;*
FoE *11 Food, Hospitality & Personal Services* is new, and comprises (ambiguously) several former FoS categories, from Business, Health and Science
FoE *12 Mixed Field Programs* has no correspondence with the FoS classification.

FoS *09 Science* has been split between FoE *01 Natural & Physical Science* and FoE *02 Information Technology*.

There are also many ambiguous changes meaning that pre-2001 courses might be linked to more than one Field of Education, but these will only dealt with insofar as they relate to Science.

A Closer look at Science Courses

Most of the mapping between Fields of Study and Education need not concern us here, but Science-related fields must be looked at more closely.

A full listing of the correspondence between the old and new classifications follows as part of this Appendix. The (apparently) unambiguous changes in Science are as follows.
Added:
FoS *09 Science* has been split between FoE *01 Natural & Physical Sciences* and FoE *02 Information Technology*.
The new FoE *01 Natural & Physical Science* has unambiguously added the following former FoSs:
FoS 010204 Soil Sciences, formerly in FoS *01 Agriculture & Animal Husbandry*
FoS 070405 Medical Technology, formerly in FoS *07 Health*
FoS 070501 Medical Science, formerly in FoS *07 Health*

Removed:
FoS 0902xx Computer Science, Information Systems was a discrete subset of FoS *09 Science*, and these courses are now classified as FoE *02 Information Technology*.
FoS 090309 Human Movement Science/ Sports Science is now indicated as FoE 069903 Human Movement (in FoE *06 Health*)
FoS 090308 Home Economics is now indicated as FoE 099901 Family & Consumer Studies (in FoE 09 *Society & Culture*)
FoS 090504 Nautical Science now FoE 031705 Nautical Science (in FoE *03 Engineering & Related Technologies*).

Certain other mapping between the old and the new is ambiguous, because some courses formerly classified as FoS *09 Science* can continue to be classified as 'Science' under its new title of FoE *01 Natural & Physical Sciences*, but could in certain circumstances be defined as falling within other Fields of Education: These are:

FoS 030204 Geography can in certain circumstances be classified as FoE 010799 Earth Sciences n.e.c., or FoE 090309 Human Geography
FoS 010206 Viticulture & Oenology can in certain circumstances be classified as FoE 019905 Food Science & Biotechnology, or FoE 050303 Viticulture.

The new FoE classification has ambiguously removed the following former Science FoSs to other FoEs

FoS 090501 Physical Science – General could in certain circumstances FoE 030505 Aircraft Operation or FoE 090507 Air Traffic Control;
FoS 090306 Environmental Science can now be shown as FoE 050999 Environmental Studies n.e.c.;
FoS 090404 Statistics & Operations Research can now be shown as FoE 091903 Econometrics;
FoS 090307 Food Science & Technology can now be shown as FoE 030307 Food Processing Technology, or within FoE *11 Food/Hospitality/Personal Services*;

It is necessary to accept that for the purposes of reporting and in published statistics there has been a re-definition of 'Science', because the former FoS *09 Science* does not exactly match the sum of FoE *01 Natural & Physical Science* and FoE *02 Information Technology*. However, it is necessary to maintain some link back to the aggregations and to the work undertaken for *Trends.* The classification of courses into Fields of Study or Education is somewhat irrelevant to deans, because it has no real impact on university operations. For instance, just because DEST has decided that Human Movement Studies/Science courses should in future be classified within the FoE *06 Health* does not mean that universities will as a consequence transfer their Human Movement Studies Department from the Faculty of Science to the Faculty of Health Studies. However, it is important to consider other factors, in particular that DEST's published statistics only report the distribution of courses according to Fields of Education. Pains have been taken therefore, to link the former FoS and current FoE classifications in an explicable way.

In producing tables for this study, a set of decisions had to be taken, to ensure that the study could make genuine comparisons over time.

The first decision was to see if historical figures should in any way amended, in light of identifiable results of mis-matches in the classifications:

Course enrolments in the following three Fields of Study which until 2001 fell **outside** FoS *09 Science* have been assumed to have been included within Science, back to 1989:
FoS 010204 Soil Science, designated as FoS *01 Agriculture/Animal Husbandry* prior to 2001;
FoS 070405 Medical Technology and FoS 070501 Medical Science, designated as FoS *07 Health* prior to 2001.

Enrolments for these three FoSs have therefore been added to historical figures for Science and reported in *Trends.* The rationale for this decision is that in the case of Soil Science and Medical Science, the descriptions are unchanged between the old and new classifications. In the case of Medical Technology, in the new classification it has been specifically re-designated 'Medical Science'. Enrolment numbers in the pre-2001 Health fields identified are quite large. In the case of 'Medical Science' one is conscious of the fact that at some universities (Melbourne in the 1980s, for instance) certain MB,BS students were permitted to take a year off from those studies to undertake a one year BMedSc degree. Such students continued to be under the Faculty of Medicine. In this case, therefore, perhaps the re-invented Science enrolment numbers will overstate the real number of 'Science' students in years 1989-1997.

The following fields of study which were linked to FoS *09 Science* prior to 2001, but have now moved to other FoES under the new classification, have not had enrolments reallocated for years 1989-1997. These are:
FoS 090308 Home Economics, now included under FoE *09 Society & Culture*;
FoS 090504 Nautical Science, now identified as FoE *03 Engineering & Related Technologies.*

In neither case are numbers large, and in neither case is the new designation anything like the former FoS designation. In the case of Home Economics, one wonders how it came to have a 'Science' classification in the first place. Perhaps it was something to do with the euphemism 'domestic SCIENCE'. Nautical Science has become 'Marine Craft Operation', a Field which had few enrolments in years 1989-1997, no enrolments in 2001, but had 312 in 2002.

The more difficult cases involve

- FoS 090309 Human Movement Science/ Sports Science, classified from 2001 as FoE 069903 Human Movement, within FoE 06 Health;

- FoS 090306 Environmental Science, which from 2001 is to be shown within FoE 05 Agriculture, Environmental & Related Studies.

Enrolments in these two areas are substantial, and the decision has been taken to continue to describe them within 'Science' in order to maintain a link between the current study and previous study undertaken on behalf of the Australian Council of Deans of Science.

In the case of Human Movement /Sports Science (old designation), and Human Movement (new designation), the mapping between the old and new classification seems clear; it is just that these courses have been moved from FoS *09 Science* to FoE *07 Health.* Despite DEST having moved such courses from FoS *09 Science* to FoE *07 Health*, it is likely that neither the courses, nor their administration within universities have changed. Therefore, for years 2001 and 2002, these courses have been enumerated as though they had continued to be designated as 'Science'.

The last problem is FoS 090306/FoE 050999, the codes used to describe Environmental Science/Studies before, and from 2001, respectively. According to the Australian Bureau of Statistics' Field of Education Correspondence Tables (ABS 2001), courses described as 090306 Environmental Science prior to 2001, could become either FoE 010905 Ecology and Evolution (and therefore within FoE 01 Natural & Physical Sciences), or FoE 050999 Environmental Studies n.e.c. (within FoE 05 Agriculture, Environmental & Related Studies) Unfortunately, there is no real correspondence between the size of enrolments before and after 2001, based on the specific instruction by the ABS. It appears many universities have coded Environmental Science courses to a generic code FoE 050900, rather than to the code designated FoE 050999 Environmental Studies n.e.c. Given this apparent ambivalence by universities, both FoEs 050900 and 050999 have been enumerated in this study as 'Science'.

In most other situations where the FoS to FoE link is ambiguous, we have to presume that universities have at all times coded their courses appropriately, both before and after the reclassification.

The remaining issue is one of nomenclature. In *Trends*, the analysis of 'Science' related exclusively to FoS *09 Science*. In this study, the expressions 'Science' and 'Science courses' have been used to reflect the end result of 'adjusting' FoS *09 Science* (for years 1989, 1993 and 1997), and FoE *01 Natural & Physical Sciences* (for years 2001 and 2002).

Because of the range of provisos and exceptions, Figure B has been prepared, as a reconciliation chart to provide a link between figures published for years 1989, 1993 and 1997 (as used unequivocally in *Trends.*…), and the figures used for all years examined in this study. For whatever reason, there are two fewer enrolments for 1989 using current DEST Aggregated data Sets, than in 1999 when *Trends* was written.

Figure B: Statistics Reconciliation Chart
Total Enrolments derived from Aggregated Data Files for current Study

	1989	1993	1997	2001	2002
Enrolments from DEST data files acquired 2003:	441074	575616	658849	725099	750940
Figures reported in *Trends….*	441076	575617	658827		
Variation (Unaccountable changes in DEST files)	-2	-1	22		
FoS *09 Science* Enrolments reported in *Trends*	60705	83678	95861		
Less: 'I/T' enrolments included (ie FoS 0902xx)	13897	21004	27991		
Net *Science* reported in *Trends*	46808	62674	67870		
FoE 01 Natural & Physical Sciences				54311	55917
FoE 02 Information Technology				56474	61446
Additions to 'Science' for years 1989 - 1997:					
Soil Sciences (from FoS *01 Agriculture*)	44	153	171		
Medical Science (from FoS *06 Health*)	1595	1270	1433		
Medical Technology(from FoS *06 Health*)	231	1675	2365		
Additions to 'Science' for years 2001 & 2002					
Human Movement (now FoE *06 Health*)				4455	4677
Environmental Science (now FoE *05 Agriculture*)				5992	6114
Sub Total	1870	3098	3969	10447	10791
New 'Science' figures, based on Additions:	48675	65772	71839	64758	66708
Information Technology	13897	21004	27991	56474	61446
Science & Information Technology	62572	86776	99830	121154	128154

For this study, Science and Information Technology courses have been placed into sub-categories for use in enrolments and course completions tables, as shown in Figure C. There is also one change internal to 'Science' to note: pharmacology, formerly reported in the Field of Study classification within Life Sciences has been moved in the Field of Education classification within Other Natural and Physical Sciences. Consequently it has been adjusted in enrolment and courses completion statistics to the sub group General/Other.

Details of the meaning of the codes can be gleaned from listings at the end of Appendix 1.

Figure C
Course Groupings used in tables in this study

Science & I/T Course Groupings	FoS Codes 1989 - 1997	FoE Codes 2001 +
General /Other	090101, 090312, 070405, 070501	010000, 019900, 019901, 019905, 019907, 019909, 019999
Life Sciences	090301 – 090399, except 090312	010900-010999, 050900, 050999, 069903
Mathematical Sciences	090401 –090499	010100 - 010199
Physical Sciences	090501 – 090599, 010204	010300 - 010799
Information Technology	090201 - 090299	020100 - 029999

A Closer look at Science and Information Technology subjects

As the two pre-2001 classifications of courses and subjects have been replaced by a single Field of Education classification, Figure D shows old and new top level classifications for subjects:

Figure D
Branches of Learning and Fields of Education

Branches of Learning Pre 2001	Broad Fields of Education 2001 +
01 Humanities	01 Natural & Physical Sciences
02 Social studies	02 Information Technology
03 Education	03 Engineering & Related Technologies
04 Sciences	04 Architecture/Building
05 Mathematics, Computing	05 Agriculture/Environmental& Related
06 Visual/Performing Arts	06 Health
07 Engineering, Processing	07 Education
08 Health Sciences	08 Management & Commerce
09Admin, Business, Eco, Law	09 Society & Culture
10 Built Environment	10 Creative Arts
	11 Food/Hospitality/Personal Services
	12 Mixed Field Programs

Source: Pre 2001: DEETYA Higher Education Student Collection Technical Documentation, Appendix E
2001 + : ABS Appendices 10 & 11. Obtained in August 2003 from http://www.abs.gov.au

The new Field of Education classification is a six-digit classification, in contrast with the four-digit Discipline Group classification which it replaced. In theory, therefore, it should be possible to describe subjects to a greater level of detail in future. However, the changes which affect 'Science' subjects provide considerable points of ambiguity in the mapping of old discipline groups to new fields of education. For instance, it was noted that from 2001, COURSES in soil Science were to be added to FoE *01 Natural & Physical Science* , and in this study, this change as been made retrospectively. However, SUBJECTS in soil Science were, until 2001, linked to Discipline Group *1101 Agriculture*. Since many other subjects (not only soil Science subjects) were ALSO linked to Discipline Group *1101 Agriculture*, one cannot therefore redistribute all of student load attributed to *1101 Agriculture* in years 1989 to 1997 to the specific Field of Education 'soil Science'. The over riding assumption which must be made is that universities have always linked subjects to the appropriate discipline group (pre-2001) or field of education (2001 +).

Given that all the potential clash points for the change in classifying subjects are ambiguous, no changes have been made to pre-2001 student load data for this report.

However, there is an important change to note. Files provided by DEST for student load are different from those they supplied for the study undertaken for *Trends.* The methodology used by DEST in 1989, 1993 and 1997 (and therefore the figures produced in *Trends*) were based on the 31 March census date each year. Student load (EFTSU) represented *actual* student load in Semester 1 for students enrolled in Semester one, plus the *estimated* student load for those students in Semester 2. Since the publication of *Trends*, DEST has re-worked student load data, so the student load figures previously reported no longer apply. Neither DEST's own publications of the time, nor the student load tables in *Trends* match DEST's reconfigured 'official' figures. However, this should not concern us; this study provides 'official' enumerations for all years 1989 to 2002. In order to simplify this issue, Figure 5 provides a reconciliation of those student load figures used in *Trends* and the 'official' figures used in this study:

Figure E
Reconciliation of reported DEST Student Load Data:

	1989	1993	1997
Figures from *Trends…*			
Science/Information Technology	78473	100232	109257
All Other	271655	349193	404847
Total	350128	449425	514104
Figures used in this report			
Science/Information Technology	79168	97768	108187
All Other	275067	343317	406540
Total	354235	441085	514727
Variation			
Science/Information Technology	695	-2464	-1070
All Other	3412	-5876	1693
Total	4107	-8340	623

Because of the ambiguities caused by the various changes, subjects have been grouped in a specific way to permit the time series analysis required by this study. These are summarised in Figure 6, and details can be found in Appendix 1.

Figure F
Subject Groupings used in tables in this study

Subject Grouping	Discipline Group Codes 1989 - 1997	FoE Codes 2001 +
Behavioural Sciences	0201	090700 - 090799
Biological Sciences	0401	010900 – 010900
Chemical Sciences	0405	010500 – 010599
Earth Sciences	0402	010700 – 010799
Mathematical Sciences	0500, 0501, 0599	010100 – 010199
Other Sciences	0404, 0499	019900 – 019999
Physical/Materials Sciences	0403	010300 – 010303
Information Technology	0502, 0503	020100 - 029999

Appendix 1 (Cont'd)

Classification of Courses and Subjects: Field of Education Correspondence Table

Part A: Field of Study to Field of Education: Science & Information Technology only

Field of Study Classification (Pre 2001)		Field of Education (2001+)	
09	**SCIENCE**		
090101	Science - General	010000	Natural and Physical Sciences, n.f.d.
090201	Computer Science, Information Systems - General (not Business Data Processing)	020000	Information Technology, n.f.d.
090202	Computer Science	020101	Formal Language Theory
		020105	Computational Theory
		020107	Compiler Construction
		020109	Algorithms
		020111	Data Structures
		020113	Networks and Communications
		020117	Operating Systems
		020119	Artificial Intelligence
		020301	Conceptual Modelling
		029901	Security Science
90203	Information Systems	020103	Programming
		020115	Computer Graphics
		020303	Database Management
		020305	Systems Analysis and Design
090203	Information Systems	020307	Decision Support Systems
090299	Computer Science, Information Systems -Other	020199	Computer Science, n.e.c.
		020399	Information Systems, n.e.c.
		029999	Information Technology, n.e.c.
090301	Life, General Sciences - General	00	No correspondence
90302	Anatomy	010903	Botany
		010913	Human Biology
		010915	Zoology
090303	Biochemistry	010901	Biochemistry and Cell Biology
090304	Biology	010901	Biochemistry and Cell Biology
		010905	Ecology and Evolution
		010907	Marine Science
		010909	Genetics
		010913	Human Biology
		010999	Biological Sciences, n.e.c.
090305	Botany	010903	Botany
090306	Environmental Science	010905	Ecology and Evolution
		050999	Environmental Studies, n.e.c.
090307	Food Science and Technology	019905	Food Science and Biotechnology
		030307	Food Processing Technology
		110111	Food Hygiene
		110199	Food and Hospitality, n.e.c.
090308	Home Economics	099901	Family and Consumer Studies
090309	Human Movement Science/Sports Science	069903	Human Movement
090310	Laboratory Techniques (not Medical Technology)	019909	Laboratory Technology
090311	Microbiology	010911	Microbiology
090312	Pharmacology	019907	Pharmacology
090313	Physiology	010903	Botany
		010913	Human Biology

n.f.d = 'not further defined' n.e.c = 'not elsewhere classified'

Field of Study Classification (Pre 2001)		Field of Education (2001_)	
09	**SCIENCE (Cont'd)**		
		010915	Zoology
090314	Zoology	010915	Zoology
090399	Life, General Sciences - Other	010713	Oceanography
		010907	Marine Science
		010999	Biological Sciences, n.e.c.
		019903	Forensic Science
		019999	Natural and Physical Sciences, n.e.c.
090401	Mathematics - General	010100	Mathematical Sciences, n.f.d.
090402	Applied Mathematics	010101	Mathematics
090403	Pure Mathematics	010101	Mathematics
090404	Statistics and Operations Research	010103	Statistics
		091903	Econometrics
090499	Mathematics - Other	010101	Mathematics
		010199	Mathematical Sciences, n.e.c.
090501	Physical Sciences - General	010000	Natural and Physical Sciences, n.f.d.
090502	Chemistry	010501	Organic Chemistry
		010503	Inorganic Chemistry
		010599	Chemical Sciences, n.e.c.
090503	Geology	010703	Geology
		010705	Geophysics
		010707	Geochemistry
		010709	Soil Science
		010711	Hydrology
		010799	Earth Sciences, n.e.c.
090504	Nautical Science	031705	Marine Craft Operation
090505	Physics	010301	Physics
090599	Physical Sciences - Other	010303	Astronomy
		010701	Atmospheric Sciences
		019999	Natural and Physical Sciences, n.e.c.
	Fields added to Science from other FoS		
010204	Soil Sciences	10709	Soil Science
070405	Medical Technology	19901	Medical Science
		19909	Laboratory Technology
070501	Medical Science	19901	Medical Science

n.f.d = 'not further defined' n.e.c = 'not elsewhere classified'

Part B: Field of Education to Field of Study : Science & Information Technology only

Field of Education (2001+)		Field of Study Classification (Pre 2001)	
01	**NATURAL AND PHYSICAL SCIENCES**		
010101	Mathematics	90402	Applied Mathematics
		90403	Pure Mathematics
		90499	Mathematics - Other
010103	Statistics	90404	Statistics and Operations Research
010199	Mathematical Sciences, n.e.c.	90499	Mathematics - Other
010301	Physics	90505	Physics
010303	Astronomy	90599	Physical Sciences - Other
010501	Organic Chemistry	90502	Chemistry
010503	Inorganic Chemistry	90502	Chemistry
010599	Chemical Sciences, n.e.c.	90502	Chemistry
010701	Atmospheric Sciences	90599	Physical Sciences - Other
010703	Geology	90503	Geology
010705	Geophysics	90503	Geology
010707	Geochemistry	90503	Geology
010709	Soil Science	10204	Soil Sciences
		90503	Geology
010711	Hydrology	90503	Geology
010713	Oceanography	90399	Life, General Sciences - Other
010799	Earth Sciences, n.e.c.	30208	Geography
		90503	Geology
010901	Biochemistry and Cell Biology	90303	Biochemistry
		90304	Biology
010903	Botany	90302	Anatomy
		90305	Botany
		90313	Physiology
010905	Ecology and Evolution	90304	Biology
		90306	Environmental Science
010907	Marine Science	90304	Biology
		90399	Life, General Sciences - Other
010909	Genetics	90304	Biology
010911	Microbiology	90311	Microbiology
010913	Human Biology	90302	Anatomy
		90304	Biology
		90313	Physiology
010915	Zoology	90302	Anatomy
		90313	Physiology
		90314	Zoology
010999	Biological Sciences, n.e.c.	30208	Geography
		90304	Biology
		90399	Life, General Sciences - Other
019901	Medical Science	70405	Medical Technology
		70501	Medical Science
019903	Forensic Science	90399	Life, General Sciences - Other

n.f.d = 'not further defined' n.e.c = 'not elsewhere classified'

Field of Education (2001+)		Field of Study Classification (Pre 2001)	
01	**NATURAL AND PHYSICAL SCIENCES (Cont'd)**		
019905	Food Science and Biotechnology	10206	Viticulture and Oenology
		90307	Food Science and Technology
019907	Pharmacology	90312	Pharmacology
019909	Laboratory Technology	70405	Medical Technology
		90310	Laboratory Techniques (not Medical Technology)
019999	Natural and Physical Sciences, n.e.c.	90399	Life, General Sciences - Other
		90599	Physical Sciences - Other
	Other disciplines added:		
069903	Human Movement	90309	Human Movement Science/Sports Sci.
050900	Environmental Studies	090306	Environmental Science
050999	Environmental Studies n.e.c.		
02	**INFORMATION TECHNOLOGY**		
020101	Formal Language Theory	90202	Computer Science
020103	Programming	90203	Information Systems
020105	Computational Theory	90202	Computer Science
020107	Compiler Construction	90202	Computer Science
020109	Algorithms	90202	Computer Science
020111	Data Structures	90202	Computer Science
020113	Networks and Communications	90202	Computer Science
020115	Computer Graphics	90203	Information Systems
020117	Operating Systems	90202	Computer Science
020119	Artificial Intelligence	90202	Computer Science
020199	Computer Science, n.e.c.	90299	Computer Science, Information Systems-Other
020301	Conceptual Modelling	90202	Computer Science
020303	Database Management	90203	Information Systems
020305	Systems Analysis and Design	90203	Information Systems
020307	Decision Support Systems	90203	Information Systems
020399	Information Systems, n.e.c.	90299	Computer Science, Information Systems-Other
029901	Security Science	90202	Computer Science
029999	Information Technology, n.e.c.	90299	Computer Science, Information Systems -Other

n.f.d = 'not further defined' n.e.c = 'not elsewhere classified'

Part C: Discipline Groups to Field of Education : Science & Information Technology only

Higher Education Discipline Groups (pre 2001)		Field of Education (2001+)	
0201	Behavioural Sciences	090701	Psychology
		090799	Behavioural Science, n.e.c.
04	**SCIENCES**		
0401	Biological Sciences	010901	Biochemistry and Cell Biology
		010903	Botany
		010905	Ecology and Evolution
		010909	Genetics
		010911	Microbiology
		010913	Human Biology
		010915	Zoology
		010999	Biological Sciences, n.e.c.
0402	Earth Sciences	010701	Atmospheric Sciences
		010703	Geology
		010705	Geophysics
		010707	Geochemistry
		010713	Oceanography
		010799	Earth Sciences, n.e.c.
		010907	Marine Science
0403	Physical/Materials Sciences	010301	Physics
		010503	Inorganic Chemistry
		030305	Materials Engineering
0404	Pharmacology	019907	Pharmacology
		060501	Pharmacy
0405	Chemical Sciences	010501	Organic Chemistry
		010503	Inorganic Chemistry
		010599	Chemical Sciences, n.e.c.
0499	Other Sciences	010303	Astronomy
		019903	Forensic Science
		019905	Food Science and Biotechnology
		019909	Laboratory Technology
		019999	Natural and Physical Sci., n.e.c.

n.f.d = ‘not further defined’ n.e.c = ‘not elsewhere classified’

Higher Education Discipline Groups (pre 2001)		Field of Education (2001+)	
05	**MATHEMATICS, COMPUTING**		
0501	Mathematics, Statistics	010101	Mathematics
		010103	Statistics
		081103	Insurance and Actuarial Studies
0502	Computer-based Information Science	020103	Programming
		020111	Data Structures
		020115	Computer Graphics
		020303	Database Management
		020399	Information Systems, n.e.c.
		029999	Information Technology, n.e.c.
		020101	Formal Language Theory
		020105	Computational Theory
		020107	Compiler Construction
		020109	Algorithms
		020113	Networks and Communications
		020117	Operating Systems
		020119	Artificial Intelligence
		020199	Computer Science, n.e.c.
		020301	Conceptual Modelling
		020305	Systems Analysis and Design
		020307	Decision Support Systems
		020399	Information Systems, n.e.c.
		029901	Security Science
		029999	Information Technology, n.e.c.
0599	Other Mathematics, Computing	010199	Mathematical Sciences, n.e.c.

n.f.d = 'not further defined' n.e.c = 'not elsewhere classified'

Part D: Field of Education to Discipline Group : Science & Information Technology only

Field of Education (2001+)		Higher Education Discipline Groups (pre 2001)	
01	**NATURAL AND PHYSICAL SCIENCES**		
010101	Mathematics	0501	Mathematics, Statistics
010103	Statistics	0501	Mathematics, Statistics
010199	Mathematical Sciences, n.e.c.	0599	Other Mathematics, Computing
010301	Physics	0403	Physical/Materials Sciences
010303	Astronomy	0499	Other Sciences
010501	Organic Chemistry	0405	Chemical Sciences
010503	Inorganic Chemistry	0403	Physical/Materials Sciences
		0405	Chemical Sciences
010599	Chemical Sciences, n.e.c.	0405	Chemical Sciences
010701	Atmospheric Sciences	0402	Earth Sciences
010703	Geology	0402	Earth Sciences
010705	Geophysics	0402	Earth Sciences
010707	Geochemistry	0402	Earth Sciences
010709	Soil Science	1101	Agriculture
010711	Hydrology	0702	Civil, Structural
		1101	Agriculture
010713	Oceanography	0402	Earth Sciences
010799	Earth Sciences, n.e.c.	0202	Geography
		0402	Earth Sciences
010901	Biochemistry and Cell Biology	0401	Biological Sciences
010903	Botany	0401	Biological Sciences
		1101	Agriculture
010905	Ecology and Evolution	0401	Biological Sciences
010907	Marine Science	0402	Earth Sciences
010909	Genetics	0401	Biological Sciences
010911	Microbiology	0401	Biological Sciences
010913	Human Biology	0401	Biological Sciences
010915	Zoology	0401	Biological Sciences
010999	Biological Sciences, n.e.c.	0202	Geography
		0401	Biological Sciences
019901	Medical Science	0806	Medicine, Medical Science
019903	Forensic Science	0499	Other Sciences
019905	Food Science and Biotechnology	0499	Other Sciences
		1101	Agriculture
019907	Pharmacology	0404	Pharmacology
019909	Laboratory Technology	0499	Other Sciences
019999	Natural and Physical Sciences, n.e.c.	0499	Other Sciences
	Added disciplines:		
090701	Psychology	0201	Behavioural Sciences
090799	Behavioural Science, n.e.c.	0201	Behavioural Sciences

n.f.d = 'not further defined' n.e.c = 'not elsewhere classified'

	Field of Education (2001+)	Higher Education Discipline Groups (pre 2001)	
2	**INFORMATION TECHNOLOGY**		
020101	Formal Language Theory	0503	Computer Science
020103	Programming	0502	Computer-based Info. Science
020105	Computational Theory	0503	Computer Science
020107	Compiler Construction	0503	Computer Science
020109	Algorithms	0503	Computer Science
020111	Data Structures	0502	Computer-based Info.Science
020113	Networks and Communications	0503	Computer Science
020115	Computer Graphics	0502	Computer-based Info.Science
020117	Operating Systems	0503	Computer Science
020119	Artificial Intelligence	0503	Computer Science
020199	Computer Science, n.e.c.	0503	Computer Science
020301	Conceptual Modelling	0503	Computer Science
020303	Database Management	0502	Computer-based Info.Science
020305	Systems Analysis and Design	0503	Computer Science
020307	Decision Support Systems	0503	Computer Science
020399	Information Systems, n.e.c.	0502	Computer-based Info.Science
		0503	Computer Science
029901	Security Science	0503	Computer Science
029999	Information Technology, n.e.c.	0502	Computer-based Info.Science
		0503	Computer Science

n.f.d = ‘not further defined’ n.e.c = ‘not elsewhere classified’

Appendix 2: Glossary of Higher Education Terms

The Glossary provides definitions of terms referred to in the text. Most of the definitions have been extracted directly from DEST's user manuals.

ABORIGINAL AND TORRES STRAIT ISLANDERS
Persons who identify themselves as being of Australian Aboriginal and Torres Strait Islander descent.

ACADEMIC ORGANISATIONAL UNIT (AOU)
The DEST name for what universities commonly refer to as "schools" or "departments". The concept of 'Faculty' as an aggregation of 'schools' or 'departments' does not exist in formal reporting to DEST.

ACADEMIC ORGANISATIONAL UNIT (AOU) GROUP
An AOU group provides a means for standardising AOUs across institutions. AOUs are assigned to an AOU group on the basis of disciplines for which each AOU has a teaching and/or research responsibility.

COMBINED COURSE
A course which has been specifically designed to lead to a single combined award (eg. BA/DipEd or BA/LLb) or to meet the requirements of more than one award (eg. BEc and BEng).

COMMENCING STUDENT
A student is a commencing student if she/he has enrolled in the course for the first time at the institution between 1 April of the year prior to the Collection Year and 31 March of the Collection Year. A Bachelor of Science student who move into Bachelor of Science (Honours) at the same university is NOT considered to be a commencing student.

COURSE
An award course, non-award course, enabling course, or cross-institution program undertaken at a higher education institution.

An award course is a program of study formally approved/accredited by the institution or any other relevant accreditation authority and which leads to an academic award granted by the institution or which qualifies a student to enter a course at a level higher than a bachelor's degree.

COURSE COMPLETION
The successful completion of all the academic requirements of a course which includes any required attendance, assignments, examinations, assessments, dissertations, practical experience and work experience in industry.

DISCIPLINE GROUP
A discipline group is a means of classifying subjects in terms of the subject matter being taught and/or researched in them.
EFTSU (EQUIVALENT FULL-TIME STUDENT UNIT)

A measure of the student load attributable to a subject or to a set of subjects. The measure indicates the notional proportion of the workload which would be applicable to a student undertaking a full year of study in a particular year, of a particular course.

ENROLMENT TYPE
A classification of the manner in which a student is undertaking a course:
Full Time / Part Time
all subjects for which the student is enrolled are undertaken through attendance at the institution on a regular basis; or where the student is undertaking a higher degree course for which regular attendance is not required, but attends the institution on an agreed schedule for the purposes of supervision and/or instruction.

Attendance is classified by the institution as being full-time or part-time based on the student load for the student aggregated across all units of study. Full Time students are those aggregating student load of 0.75 EFTSU or more.
External
all subjects for which the student is enrolled involve special arrangements whereby lesson materials, assignments, etc. are delivered to the student, and any associated attendance at the institution is of an incidental, irregular, special or voluntary nature.

FEE-PAYING STUDENT
A student for whom a fee is paid to the institution for tuition.

FIELD OF STUDY CLASSIFICATION
A classification of courses based on similarity in terms of the vocational field of specialisation or the principal subject matter of the course.

OVERSEAS STUDENT
A student who is NOT one of the following:
an Australian citizen; or
a New Zealand citizen, or a diplomatic or consular representative of New Zealand, a member of the staff of such a representative or the spouse or dependent relative of such a representative; or
a person entitled to stay in Australia, or to enter and stay in Australia, without any limitation as to time and resides in Australia during the semester.

PELS
Postgraduate Education Loans Scheme

STUDENT LOAD See EFTSU.

SUBJECT
The basic component of a course or program, which a student may undertake and on successful completion of the unit's requirements, gain credit towards completion of the course.