

Analysis of Graduate Income Data 2002-2007 by Broad Field of Study

Working Paper by
The Ministry of Women's Affairs
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Analysis of Graduate Income Data 2002-2007¹ by Broad Field of Study²

Introduction

This paper is a preliminary step in the first of four workstreams designed to better understand and address the causes of the gender pay gap. The four workstreams are:

- Understanding the differences in pay between male and female workers with tertiary education
- Occupational segregation: promoting trades and removing barriers for women
- Career pathways for women in low-paid occupations
- Making the business case for flexible work arrangements.

The work results from additional funding announced in the 2009 Budget of \$2 million over four years to do more work on the gender pay gap.

Executive Summary

The Ministry of Women's Affairs has completed a limited analysis of male and female graduate incomes using the Student Loans and Allowances Integrated dataset of students who left university between 2001 and 2006. The study examined differences in income between male and female graduates one and five years after entering employment following completion of a level 7 (bachelor's degree) or higher qualification. The analysis is limited because the field of study data was provided in terms of broad fields (e.g. Health, Education, Management and Commerce) and the income data (sourced from Inland Revenue) provides no information on hours of work or occupation.³

¹ The student loans integrated data set allows us to analyse the income students were earning one year after leaving study for the years 2001 to 2006, but five-year income data is only available to 2006.

² Field of study data is coded according to the New Zealand Standard Classification of Education (NZSCED). NZSCED has three levels of detail. At the highest level, fields are categorised into 12 broad fields. Below this, fields can be coded to one of 71 arrow fields. At the most detailed level, there are 376 detailed NZSCED field of study codes.

³ The findings of the analysis are, however, consistent with the findings of a much more comprehensive analysis completed by Mare and Hyslop (2006) using 1996 and 2001 census data which showed female earnings to be lagging behind male earnings across a wide range of narrower study fields.

Key findings are:

- Women continue to graduate in increasing numbers and 62 percent of all bachelors' graduates in 2006 were women. While women remained dominant in the fields of teaching and nursing they also outnumbered men in business and management, sales and marketing, and law, the top fields of graduation for men in 2006.
- The least preferred fields of study for women were engineering and related technologies, and information technology where men outnumbered women by five to one and four to one respectively.
- One year after entering employment the average income gap between men and women with a bachelor's qualification or above was around 6 percent, after five years (2002 -2006)⁴ the average income gap had increased to 17 percent. While these figures mask significant variations across fields of study, it is a notable gap that warrants further examination.
- There was a significant premium for women attached to gaining a bachelor's level or above qualification with income premiums 20 to 47 percent higher after five years.

Purpose

The purpose of this paper is to analyse the differences in incomes between men and women leaving tertiary education and entering the workforce. The analysis uses data from the Student Loans and Allowances Integrated data set. This data set links income data from Inland Revenue to individuals through their student loan number. The analysis therefore only includes those students entering employment who also had a student loan. The uptake of student loans throughout the period analysed varied from 72-82 percent for full time students. The income data is linked to the student's field of study so we are able to look at differences in income by field of study after one and five years in the labour market.

Data Limitations

The analysis is limited because the data does not capture occupation or hours of work and, therefore, does not allow us to understand the reasons behind observed income differences. Income is also linked only to broad fields of study within which there are often many different narrower fields. The most diverse is society and culture which includes the relatively high earning fields of economics and law

⁴ Income data for graduates five years on is only available to 2006. The income data for graduates earning income after one year is available to 2007 (year of leaving 2006).

alongside the relatively lower earning fields of social sciences and languages. The Ministry of Education has analysed in more depth trends in the narrower fields of study for students graduating with a bachelor's degree and some of those findings are referred to in this paper.

The Department of Statistics, in collaboration with the Ministry of Education, also released on 30 September⁵ an analysis of what tertiary students earn using a narrower breakdown of field of study. The Ministry of Education/Statistics analysis does not analyse earnings by gender, but confirms that qualifications matter and that study which relates most closely to occupation provides the best returns.

The focus of this study is on men and women leaving tertiary education with a level 7 or above qualification (equivalent to a bachelor's degree or higher). The majority of students leave with a bachelor level qualification. The appendix to this paper provides tables of the numbers of males and females by field of study as well as the numbers of men and women earning income one and five years after graduating.

Field of Study – Differences in study patterns between men and women

Over the past decade the numbers of young people engaged in tertiary education have increased significantly. Women now occupy more than 60 percent of university places while men are more likely to be studying at a polytechnic or technical institute. The three most common fields of study at bachelor degree level have remained unchanged over the last five years – teacher education, business and management, and studies in human society. Biological sciences, law, and sales and marketing have increased in popularity.

⁵ 'What do Tertiary Students Earn' by David Scott, 30 September 2009

Table 1: Percentage of domestic bachelor's degree graduates in 2006 by broad field of specialisation and gender⁶

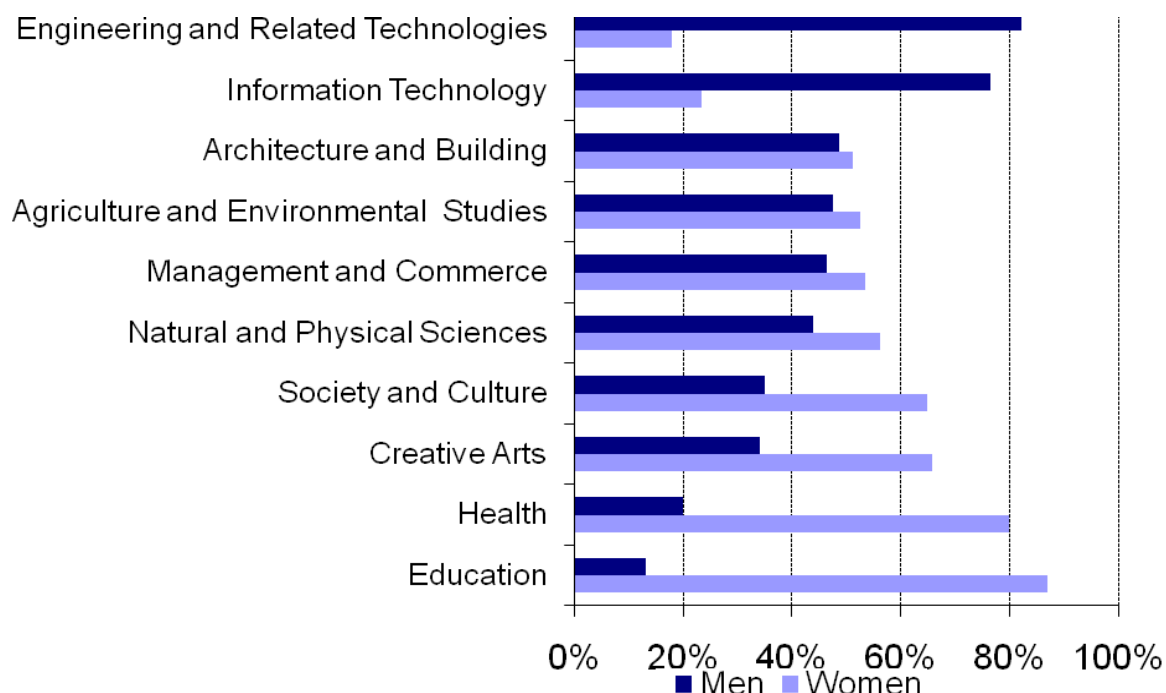


Table 1 shows the distribution of men and women by field of study graduating with a bachelors' degree in 2006. It shows that women are now studying in greater numbers across every broad field of study except in the fields of Engineering and Information Technology. The proportion of domestic bachelors' graduates who were female remained about the same between 2002 and 2006 at around 62 percent. There were two fields where females increased their share of graduates from under 50 percent to over 50 percent between 2002 and 2006.

In agriculture, women were 51 percent of graduates compared with 32 percent in 2002, while in the health field women made up 62 percent of graduates in dental studies (includes both dentistry and allied dental professions) compared with 35 percent in 2002 (Scott, 2009).

Scott (2009) explores in some depth the fields of study at bachelor level within a narrower breakdown. Table 2 below shows the top five narrow fields of study that men and women with a bachelor's degree graduated from in 2006. While teaching and nursing are the dominant fields of study for women, women outnumber men in business and management, sales and marketing, and law, the top fields of graduation for men. Further analysis of the numbers of male and female graduates within each broad field of study broken down into their narrower fields reveals the dominance of women within almost all fields that were, in the past, dominated by men. For example, all medical specialties, with the exception of surgery, are now

⁶ Tables 1,2 and 3 are taken from 'Trends in field of study of Bachelors degree graduates in New Zealand' by David Scott, April 2009. The total in Table 1 is in the middle because the graph sorts in ascending order of specialisation for women and descending order of specialisation for men.

more heavily populated by women. Similarly across all fields of law, women graduates outnumber male graduates.

Table 2: The five most common narrow fields of study for women and men graduating with a bachelor's degree in 2006

Women			Men		
Field of study (narrow level)	Number of graduates	Percentage of all females	Field of study (narrow level)	Number of graduates	Percentage of all males
Teacher Education	1,820	13.9%	Business and Management	830	10.5%
Nursing	1,220	9.3%	Sales and Marketing	560	7.1%
Studies in Human Society	1,060	8.1%	Law	500	6.3%
Business and Management	980	7.5%	Studies in Human Society	490	6.2%
Law	810	6.2%	Information Systems	490	6.2%
All fields	13,060	100%	All fields	7,890	100%

Note: Students can be counted in more than one field

Table 3 provides data on the five most common and least common narrow fields of study for women who graduated with a bachelor's degree in 2006 and the percentage of women graduating in these fields. Engineering and related technologies remain the area of study least preferred by women.

Table 3: The five most and least common narrow fields of specialisation for domestic female bachelor's degree graduates in 2006

Most common			Least common		
Field of study (narrow level)	Number of female graduates	Percentage of graduates in this field who were female	Field of study (narrow level)	Number of female graduates	Percentage of graduates in this field who were female
Nursing	1,290	94%	Mechanical and Industrial Engineering and Technology	260	9%
Teacher Education	2,100	87%	Electrical and Electronic Engineering and Technology	410	11%
Curriculum and Education Studies	930	86%	Civil Engineering	240	14%
Human Welfare Studies and Services	430	85%	Physics and Astronomy	90	15%
Radiography	110	83%	Computer Science	540	16%
All fields	13,060	62%	All fields	13,060	62%

Note: Students can be counted in more than one field

Student Numbers entering employment 2002-2007⁷

The Student Loans and Allowances Integrated data used in the following analysis shows that numbers of women entering the workforce with a bachelor's degree and above increased by almost 100 percent in 2007 compared with 2002 (from 8,331 to 15,966). Male numbers increased by two thirds but from a lower base increasing from 6333 to 10,086. For those leaving with a level 1-7 qualification, numbers of women more than doubled over this five year period, increasing from 12,408 to 26,907, while numbers of men entering employment with a level 1-7 qualification had increased from 13,726 to 21,860.

Table 4 shows the numbers of male and female students who were earning income a year after leaving by their field of study in both 2001 and 2006 with level 7 and above qualifications. The table confirms that by 2007 more women than men were entering the workforce from almost every field of study. Women dominated health, education, society and culture (incorporates law), the creative arts, and management and commerce. Males remained dominant in information technology, engineering, and the natural and physical sciences and, in the former two fields, outnumbered women by five to one and, four to one respectively in 2006 (the year in which they left study). On the other hand women outnumbered men by four to one and three to one respectively in the fields of education and health.

⁷ The years 2002 to 2007 are the first years of earning income for students who left university in 2001 and 2006 respectively.

Table 4: Females and males earning income one year after leaving study by field of study 2003 and 2007

Level 7+	2002*		2006*	
	Males	Females	Males	Females
Natural and physical sciences	741	483	1101	1035
Information technology	429	132	414	123
Engineering and related technologies	417	114	762	168
Architecture and building	126	66	171	123
Agriculture, environmental and related studies	123	90	186	180
Health	357	1245	594	2736
Education	663	1845	816	3105
Management and commerce	1551	1590	2493	2697
Society and culture	1227	1779	2244	3783
Creative arts	456	690	804	1338
Food, hospitality and personal services	3	30	9	57
Mixed field programmes	240	267	492	621
Total	6333	8331	10086	15966

* Year of leaving – income earned in following year.

Table 5 shows the numbers of men and women with a level 7 or higher qualification who left study in 2001 still earning income five years later. As the table shows, there is a significant decrease in the numbers of students who left in a particular year who were still in the workforce five years on.

Table 5: Drop in numbers of male and female students earning income after 5 years

Level 7+	2002	2006	% change	2002	2006	% change
	Males			Females		
Natural and physical sciences	741	528	28.7	483	357	26.1
Information technology	429	351	18.2	132	111	15.9
Engineering and related technologies	417	279	33.1	114	72	36.8
Architecture and building	126	90	28.6	66	48	27.3
Agriculture, environmental and related studies	123	96	22.0	90	69	23.3
Health	357	234	34.5	1245	969	22.2
Education	663	570	14.0	1845	1,605	13.0
Management and commerce	1551	1,107	28.6	1590	1,194	24.9
Society and culture	1227	924	24.7	1779	1,323	25.6
Creative arts	456	354	22.4	690	495	28.3
Mixed field programmes	240	180	25.0	267	219	18.0
Total	6333	4,713	25.6	8331	6,462	22.4

One in four men and more than one in five women who began earning income in 2002 were no longer earning income five years later (25.6 percent men and 22.4 percent women). This is likely to be the result of graduates either going overseas or returning to further study.

Graduate Incomes

This section looks at differences in the incomes earned by men and women with a higher level qualification (level 7 and above). Graph 1 shows the gap in average incomes earned by men and women one year after leaving study for those with a level 7 or higher qualification over the years 2002 to 2007. After one year of employment the income gap between male and female graduates averages around 6 percent. This average masks quite significant variations within different fields of study. Women leaving with information and technology or agricultural and environmental qualifications, for example, earned more on average after one year than men. On the other hand, the income gap for males and females with a health qualification averaged more than 20 percent within a year.⁸

Graph 1: Income gap between men and women with level 7+ qualifications 1 year after leaving study (year of leaving)



⁸ The large gap in incomes in health is likely to be partly explained by the high level of occupational segregation in the sector: lower paid nursing jobs are dominated by women, while the highest paid jobs (e.g. surgeons) are dominated by men.

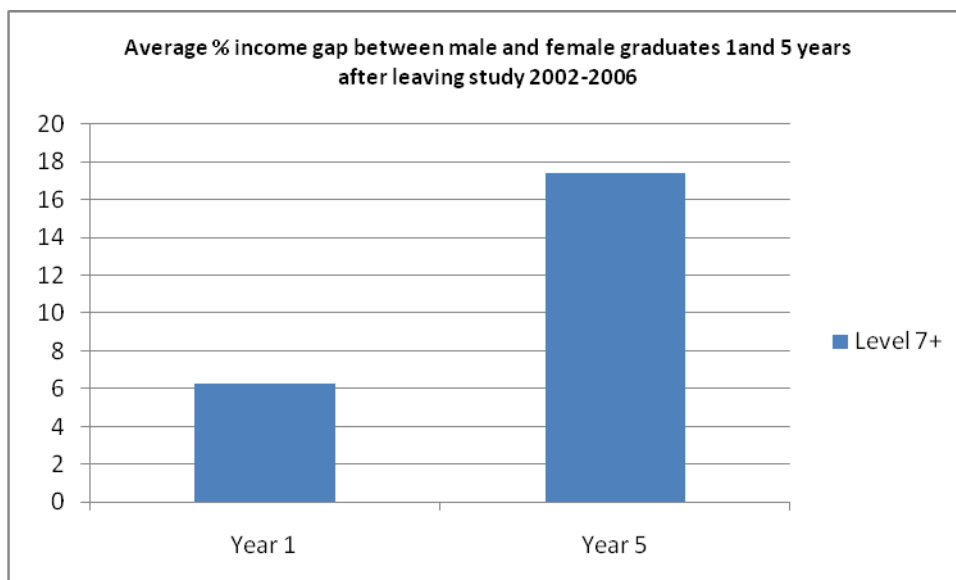
Table 6 shows that over most fields men are gaining significantly larger percentage increases in income than women five years out from leaving study. For students finishing in 2002 with a level 7+ qualification, the disparity ranged from 7 percent (creative arts) to 42 percent (agriculture). While these numbers may be skewed by the very small number of students choosing to study agriculture at Level 7 and above, the way in which the incomes of men who studied agriculture were growing at a far higher rate than those of women is striking, particularly given a breakdown of agriculture into narrower fields shows little difference in terms of what was studied within agriculture by men and women. The difference in the income progression of management and commerce majors is also interesting as, again the fields of study within management and commerce are not noticeably different between men and women.

Table 6: Percentage increase in income after 5 years post-study (students leaving study in 2002, Level 7 and above)

Field of Study	Percentage increase in salary after 5 years post-study (men)	Percentage increase in salary after 5 years post-study (women)	Percentage point difference in increase between men and women
Physical Sciences	63	47	16
Information Technology	62	53	9
Engineering	61	33	28
Agriculture	78	36	42
Health	61	28	33
Education	35	26	9
Management and Commerce	64	43	21
Society and Culture	56	38	18
Creative Arts	57	50	7

The differences in income progression between men and women shown above, translate after five years, into an average income gap between men and women who left study in 2002 of 17 percent (as shown in Graph 2). While that figure also masks significant variations, as the table above shows, it is a significant gap. It is not possible from this data to say what is driving this gap but, given that women outnumber men in almost every field of study, it is of some concern their incomes are falling significantly behind after just five years in the workforce. It suggests that women are not progressing as quickly in their careers as men, or that women are choosing careers which are not as well paid. Alternatively it may be that men are simply being paid more for their qualifications than women because they negotiate better starting salaries and ongoing increases in pay.

Graph 2: Average percentage income gap between male and female graduates 1 and 5 years after leaving study 2002-2006



A Premium Exists for Higher Education

While the income gap for men and women with a level 7+ qualification is notable and warrants further investigation into what is driving this gap, Table 7 below shows it is still worthwhile for women to gain a tertiary level qualification. Income premiums for women with a bachelor's degree or higher range from 9 to 42 percent in the first year across different fields of study and remain at 20-47 percent after five years. The largest differentials occur in the fields of management and commerce, and health. This is what we would expect given the costs of investing in a longer tertiary education.

Table 7: Percentage difference in income for women with level 1-7 qualification⁹ and level 7+ qualification by field of study after 1 (2002) and 5 years (2006)

Field of Study	After 1 year (%)	After 5 years (%)
Information Technology	24.0	36.0
Engineering & Related technologies	35.0	31.0
Agriculture	36.9	46.6
Health	41.3	41.1
Education	21.0	21.1
Management and Commerce	34.8	39.3
Society and Culture	21.8	26.6
Creative Arts	14.0	20.2

⁹ Level 1-7 qualifications are qualifications below degree level and include level 1-4 trade certificates.

Conclusions

The findings establish a clear income differential between men and women who graduate within the same fields of study. The income gap emerges after only one year (men are paid 6 percent more on average) and increases to 17 percent after five years.

While the income gap varies between different fields of study, no matter what area of study is pursued an income gap in favour of men has emerged after five years.

It should be noted, however, that the Inland Revenue data used in this study is limited because it does not provide us with information regarding occupation, and the fields of study are extremely broad. Notwithstanding that, we would not expect to see income levels diverging as significantly as they appear to after five years, particularly given the years immediately after leaving tertiary education are likely to be prime earning years and, for women, less likely to be affected by the arrival of children. Similar findings were reported by Mare and Hyslop in 2006 who, in a comprehensive analysis of 1996 and 2001 census data, found that across most fields of study, median incomes for women were lower than for men, particularly in the higher income percentiles. This work is currently being updated using 2006 census data.

On a positive note, the data validate the higher returns that can be earned by both men and women from investing in education: your income is likely to be significantly higher if you have a bachelor's degree or above, regardless of gender. Increasing numbers of women are studying for a higher level qualification and this will have improved their income earning potential.

A number of issues for further examination arise from the findings, including:

- Whether it boils down to salary differentials or whether the differences are explained by the occupations that men and women choose and the motivations that lie behind the career decisions made by men and women.
- Whether women would be more likely to start on a level playing field in some occupations if they had better information about negotiating and starting salaries.

Future work by the Ministry will aim at answering these questions and ensuring that women are armed with information on pay differences to use at key points in their careers (e.g. when deciding which subjects to study; when negotiating their employment contract for their first job after graduating).

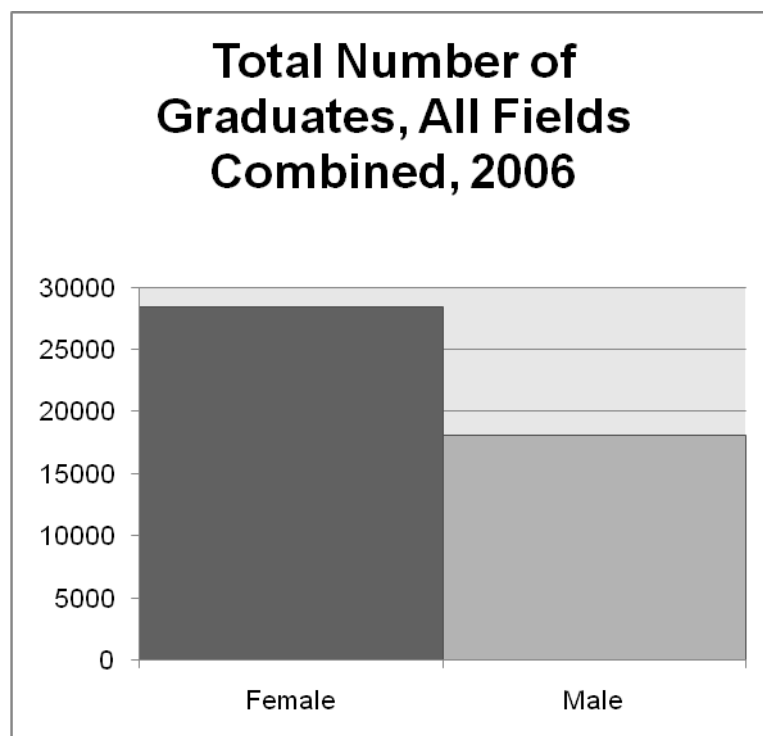
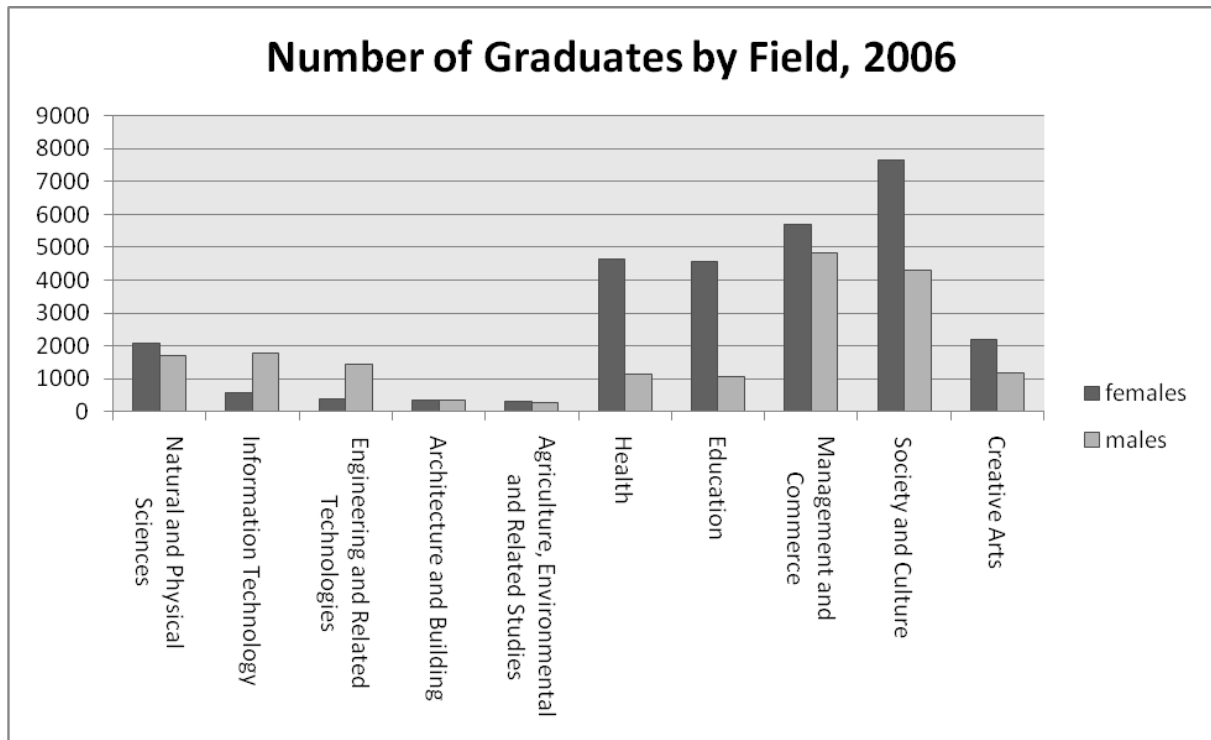
Understanding what these data tell us is not just important for the women concerned, but also for the New Zealand economy. Lower income points towards

a likely under-utilisation of women's education and skills, yet demographic trends suggest that economic growth will be increasingly dependent on increased women's participation in the workforce.

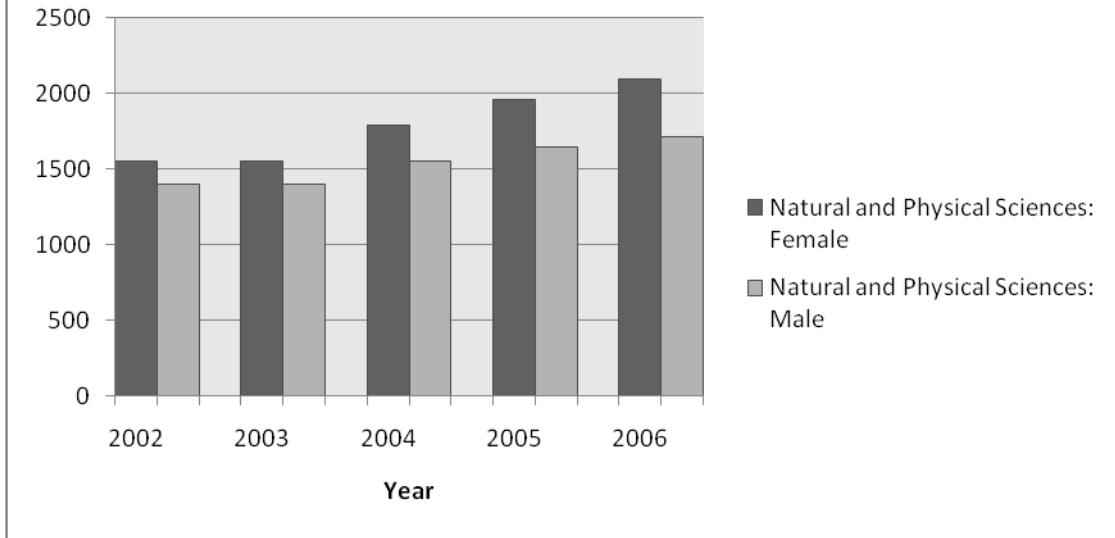
The data also raise some important questions that are not specifically to do with gender. For example, given the costs of educating a person to level 7 and above, it is interesting to note that more than one in five graduate men and women are no longer earning income in New Zealand after five years. In the case of women, this is unlikely to be explained by taking time out to have children as the average age of childbirth is now 28. The more likely explanations are departure overseas or a return to further study. Travelling and working overseas is a common rite of passage for many New Zealanders in their twenties and an opportunity to gain experience that cannot necessarily be gained in New Zealand. Provided these men and women return to New Zealand the investment in their education is not lost and may be enhanced through their experiences elsewhere. This is another area that may warrant further exploration.

APPENDIX

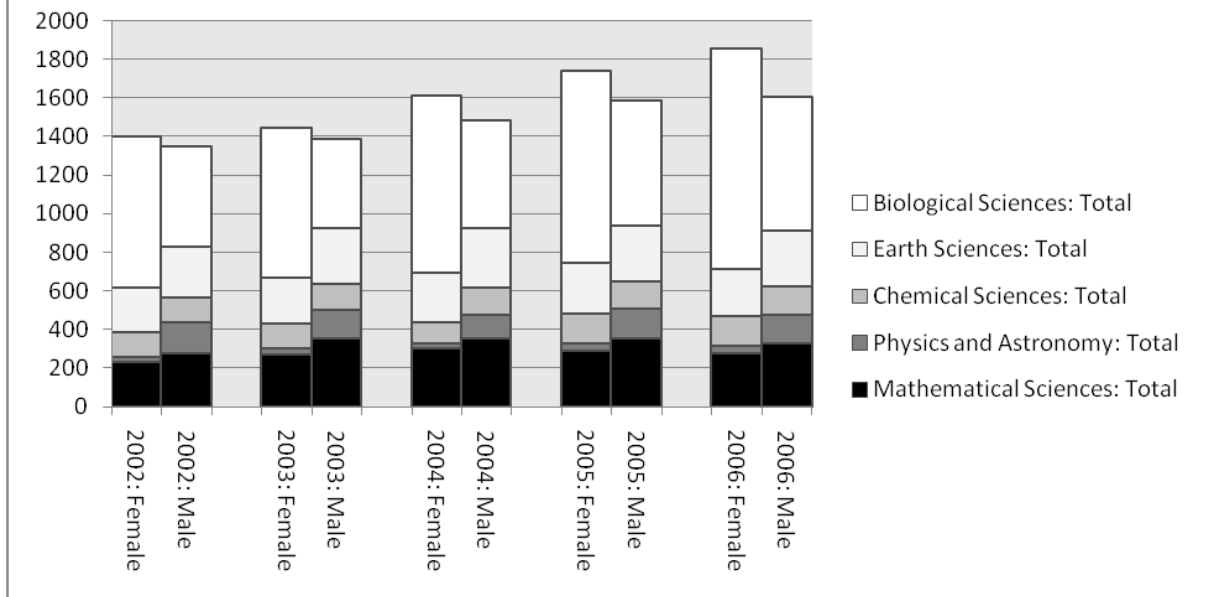
Breakdown of Graduate Numbers by Area of Study



Number of Male and Female Graduates: Natural and Physical Sciences

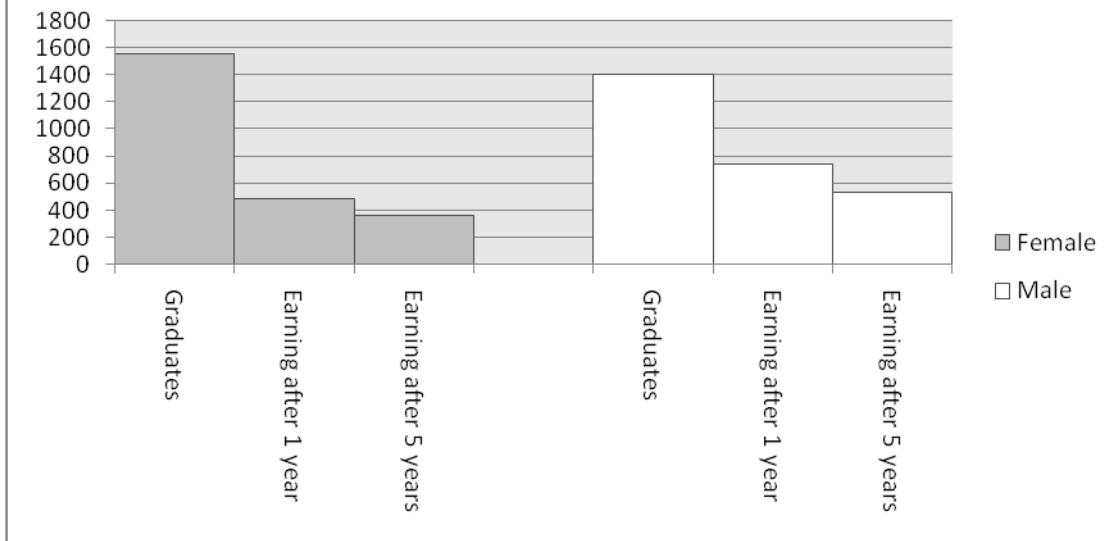


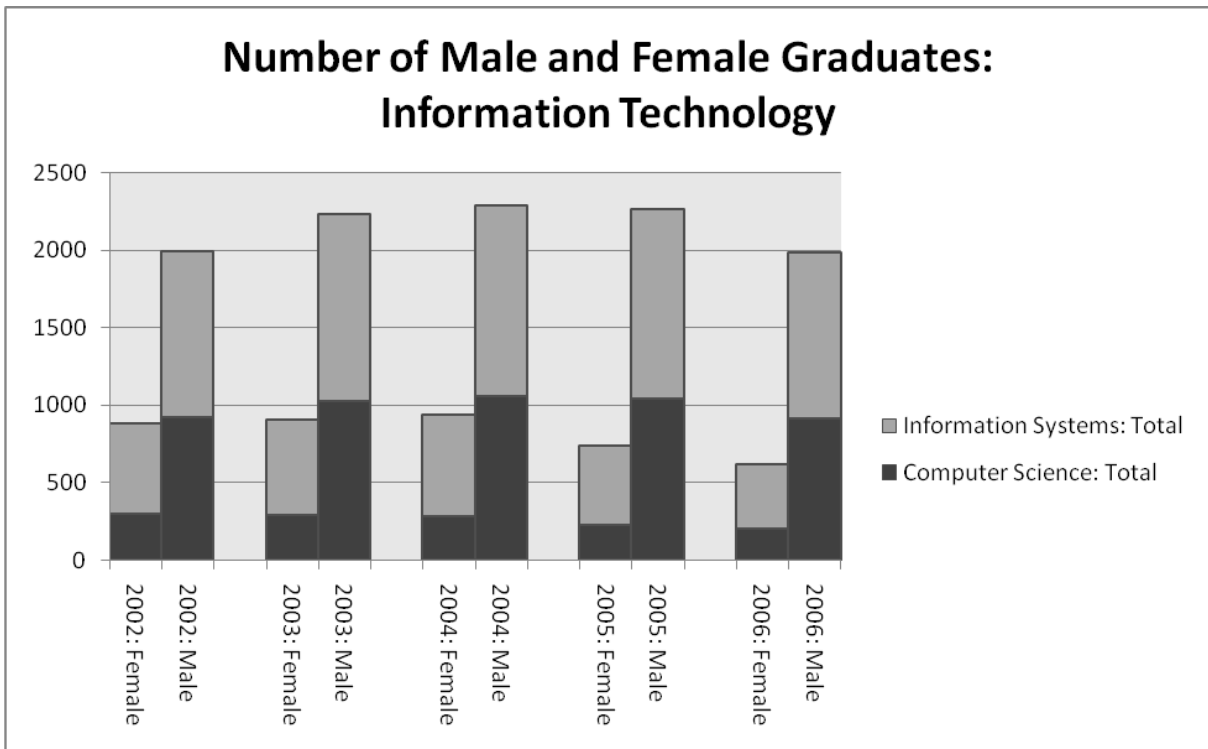
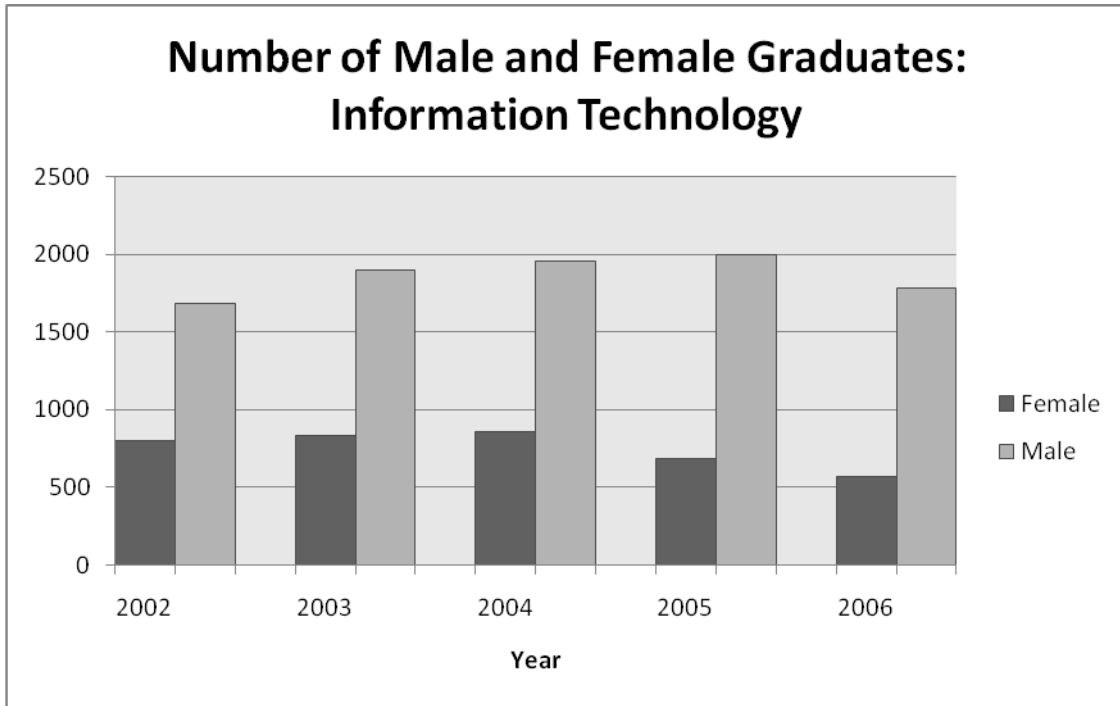
Numbers of Graduates: Natural and Physical Sciences



Note: figures in this chart exclude the category 'Other Natural and Physical Sciences.'

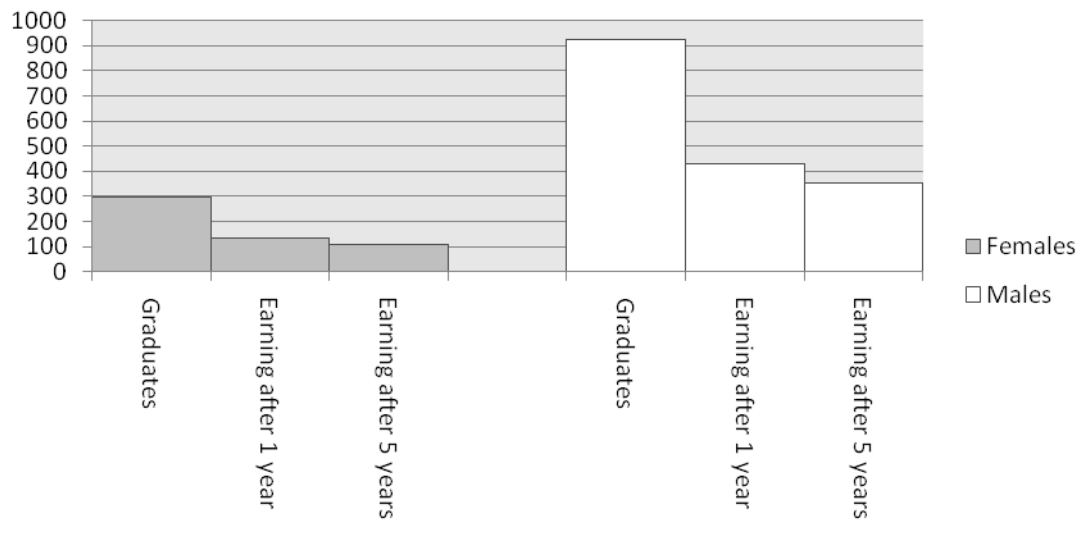
Number of Graduates in Natural and Physical Sciences (2002) Earning Income

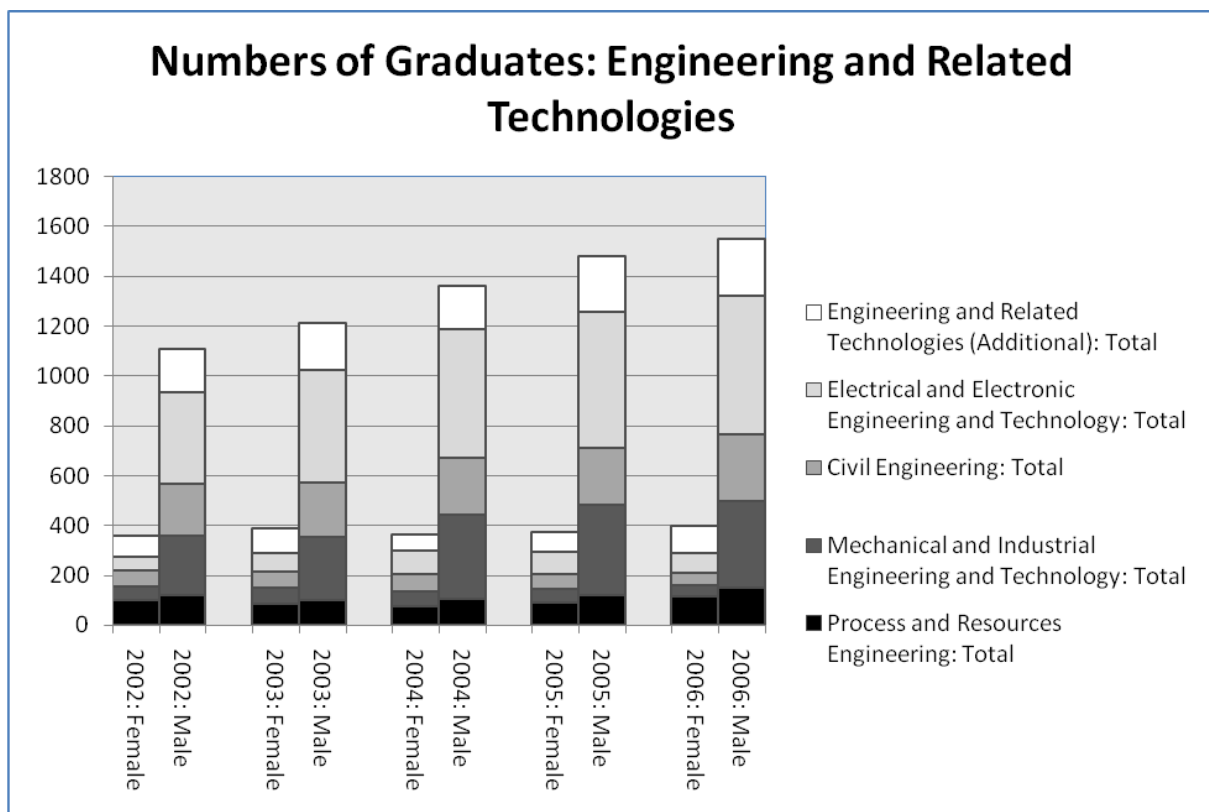
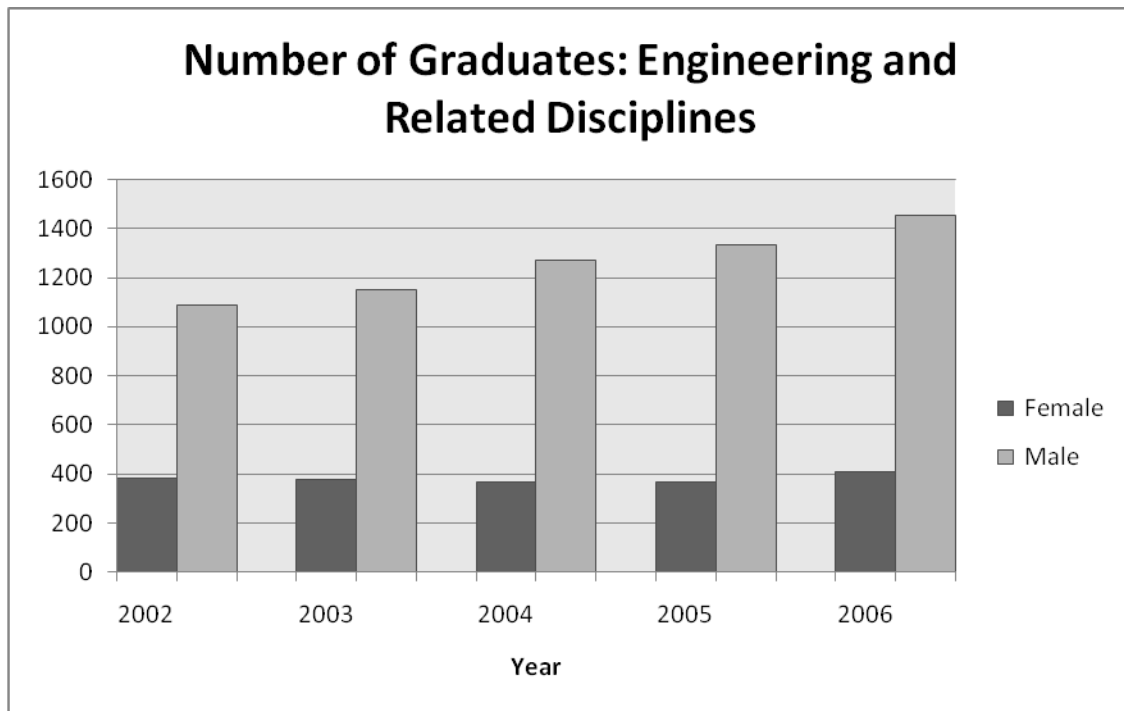




Note: figures in this chart exclude the category 'Other Information Technology.'

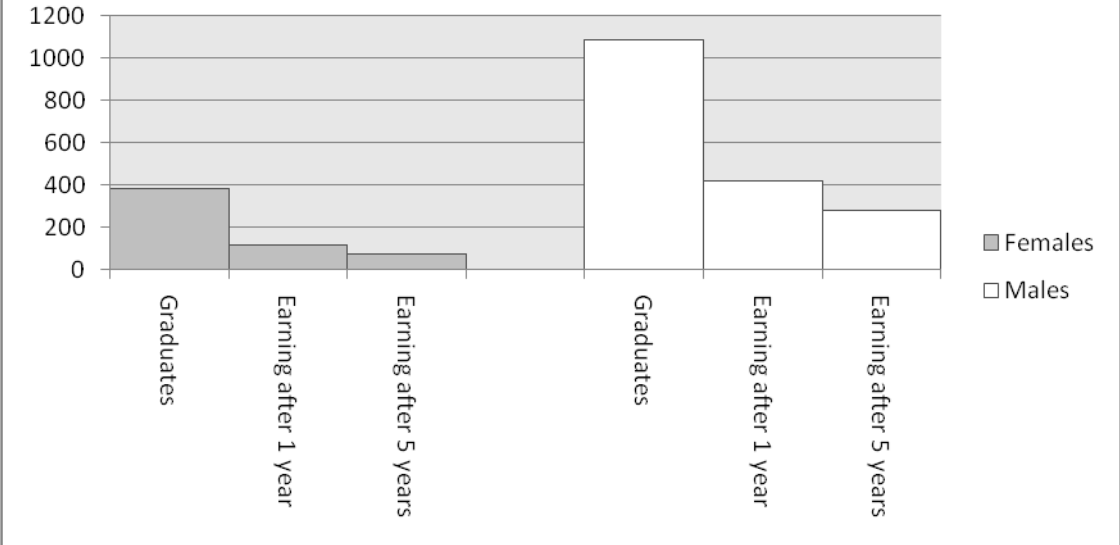
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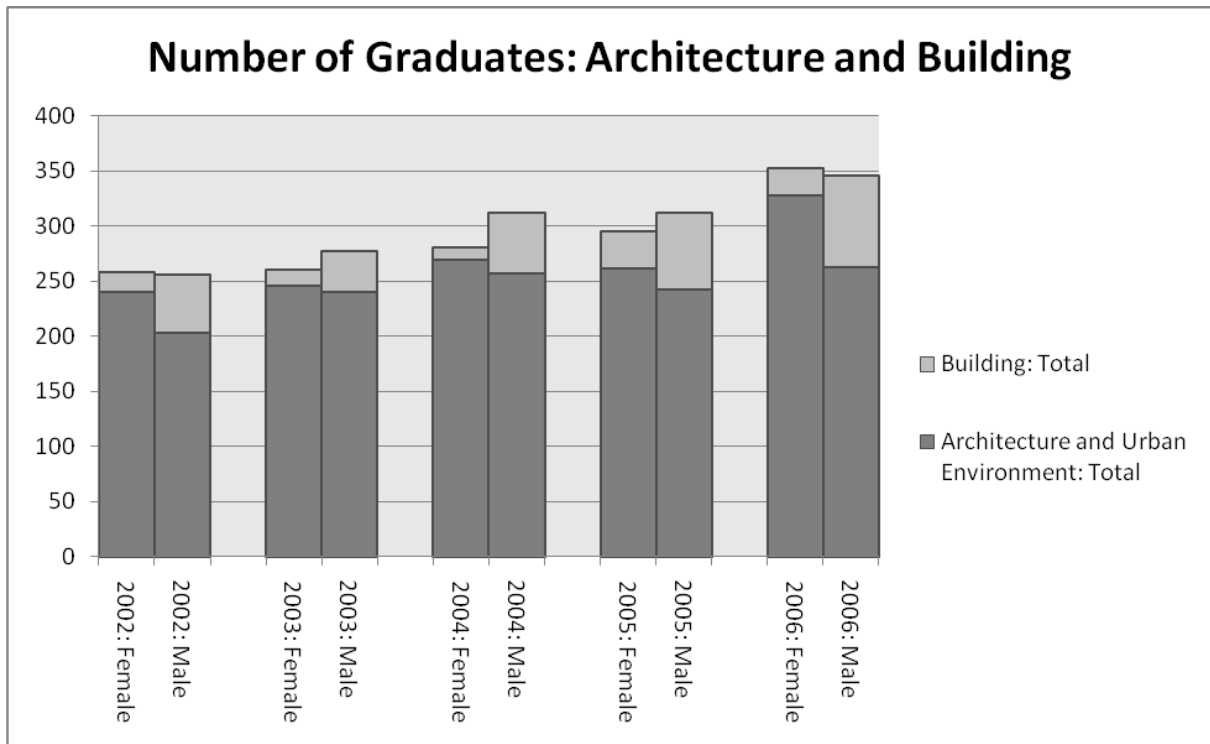
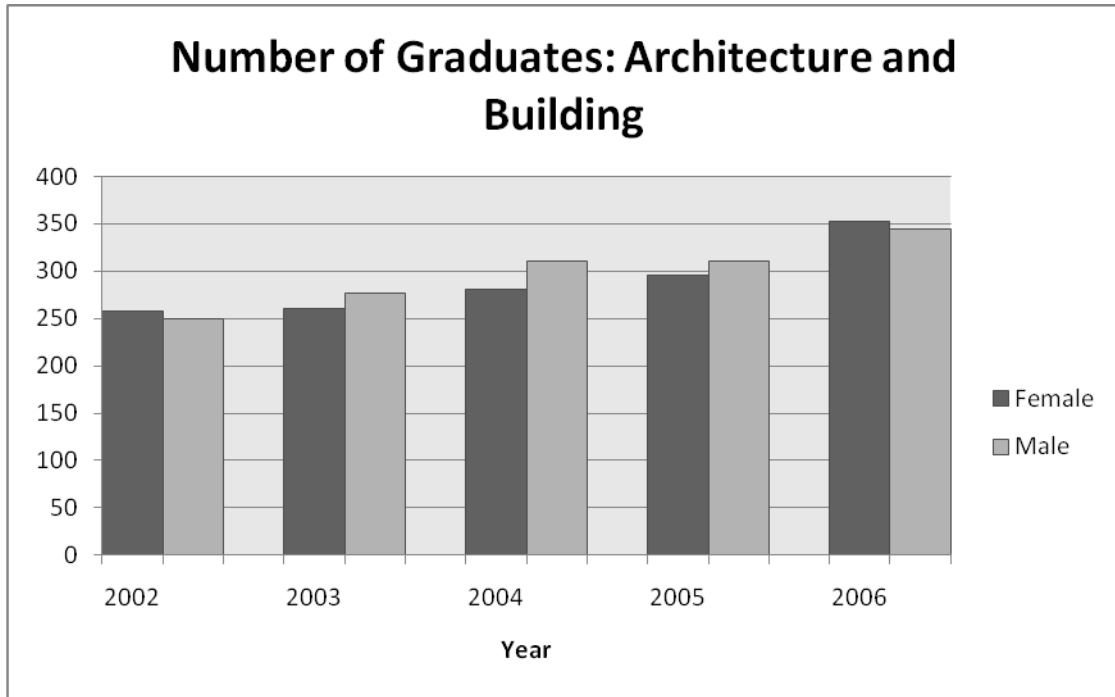




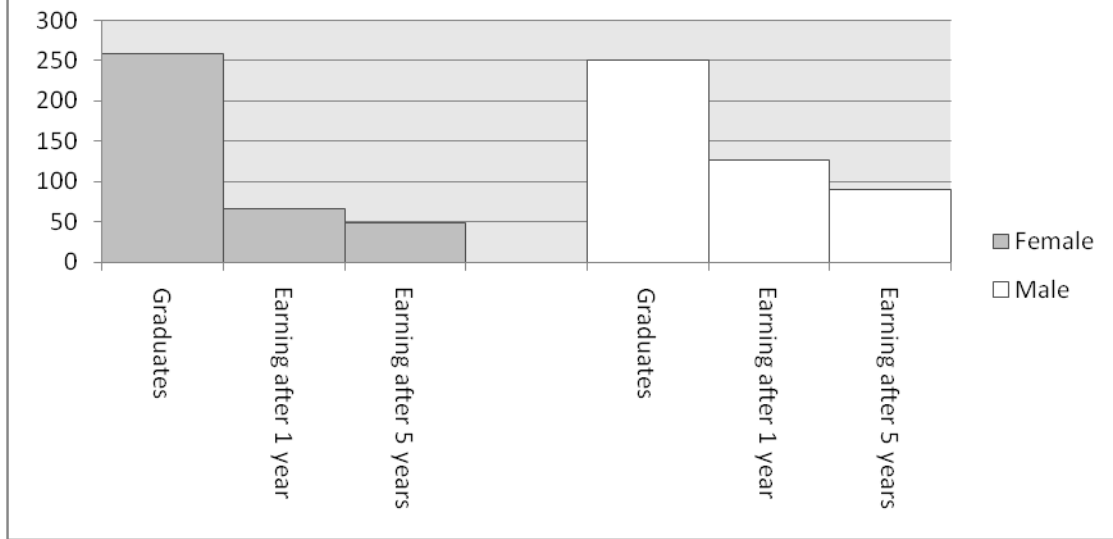
Note: figures in this chart exclude the category 'Other Engineering and Related Technologies.'
 'Engineering and Related Technologies (Additional)' includes Manufacturing and Process Engineering, Geomatic Engineering and Aerospace Engineering.

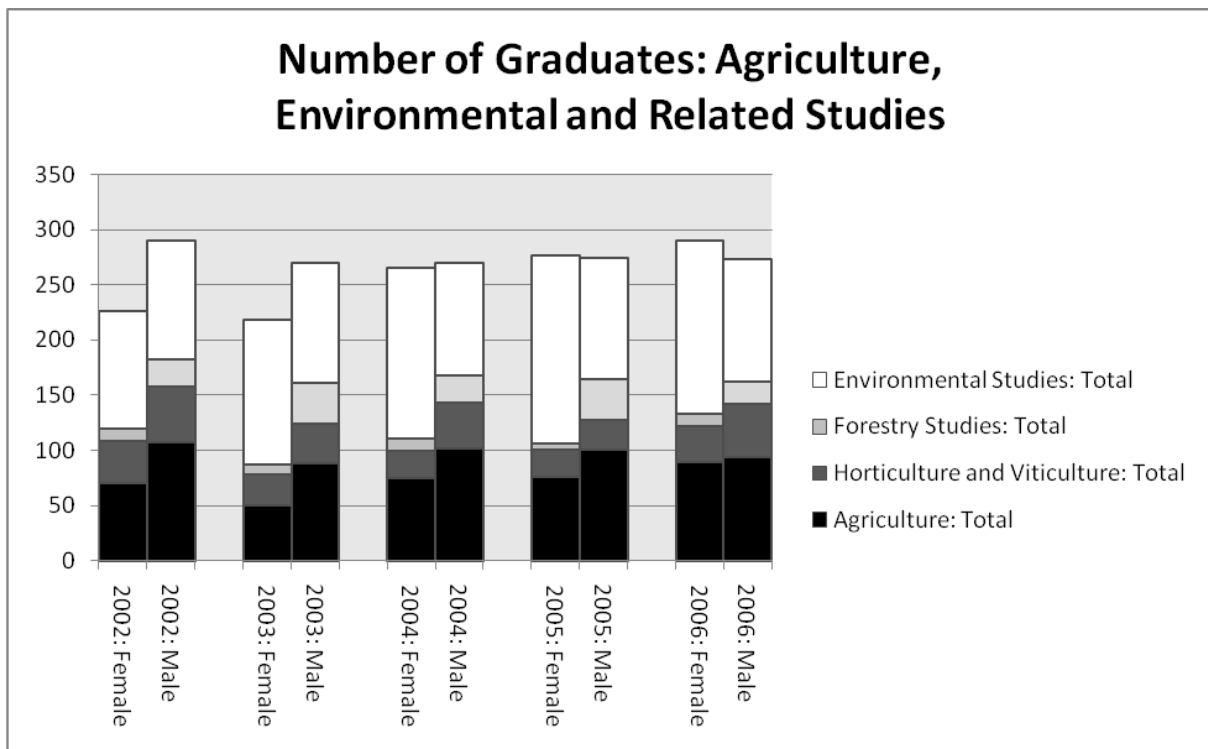
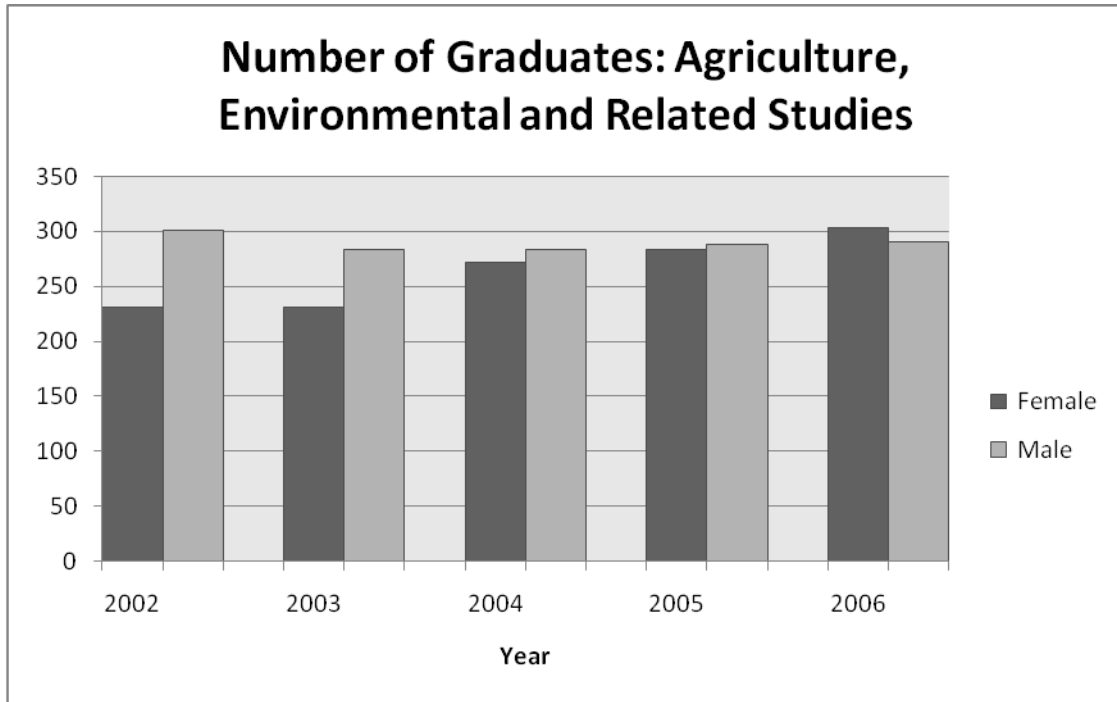
Numbers of Graduates in Engineering and Related Disciplines (2002) Earning Income





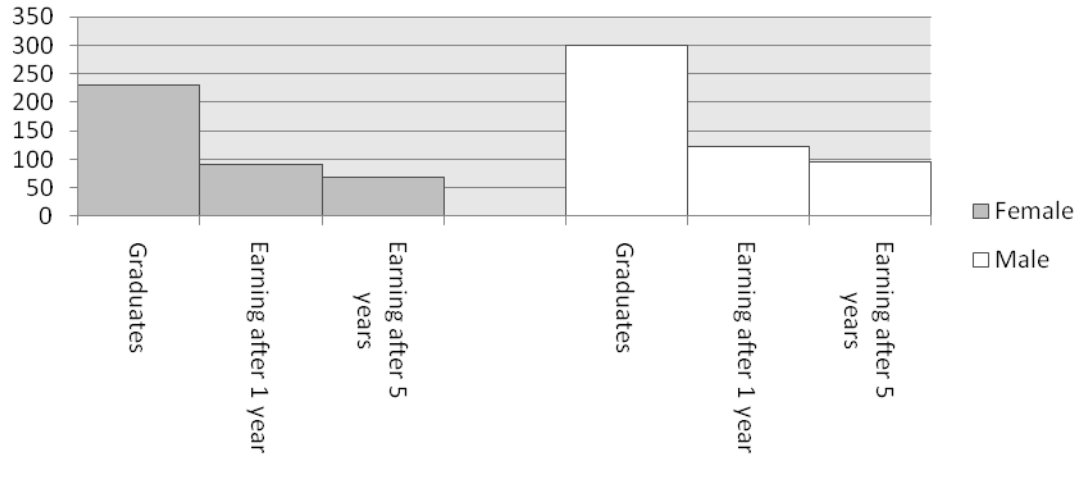
Number of Graduates in Architecture and Building (2002) Earning Income

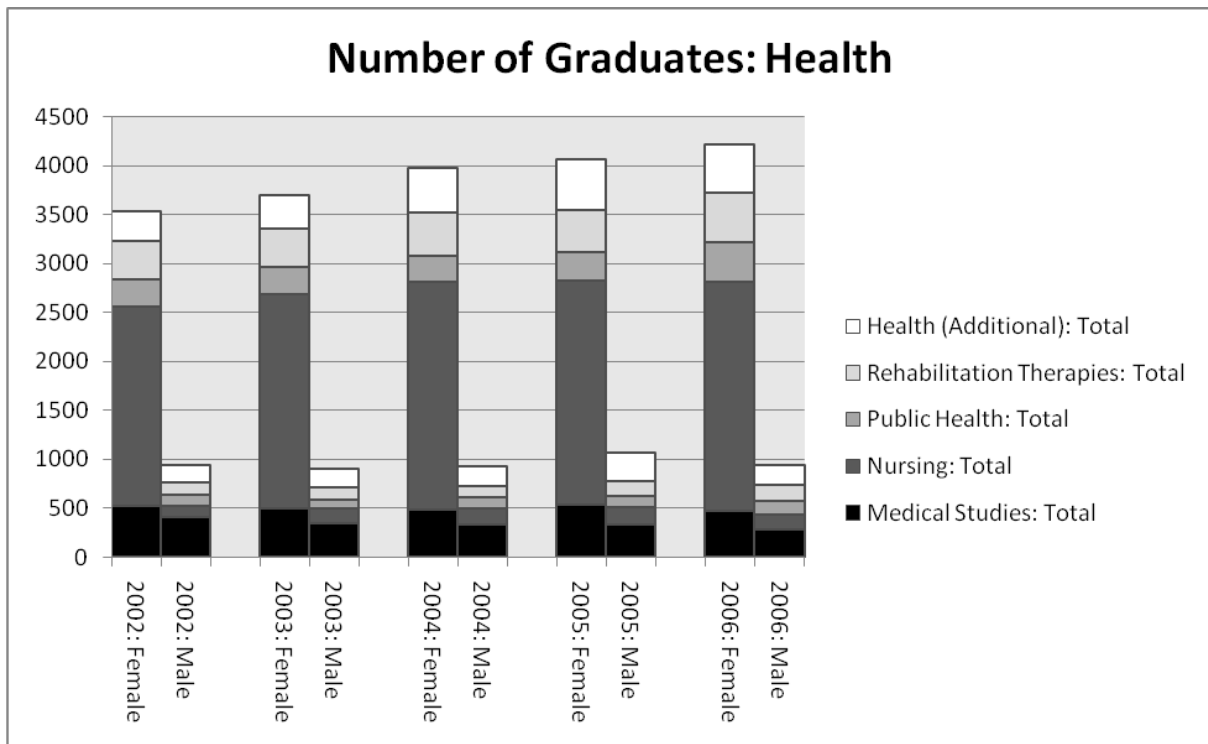
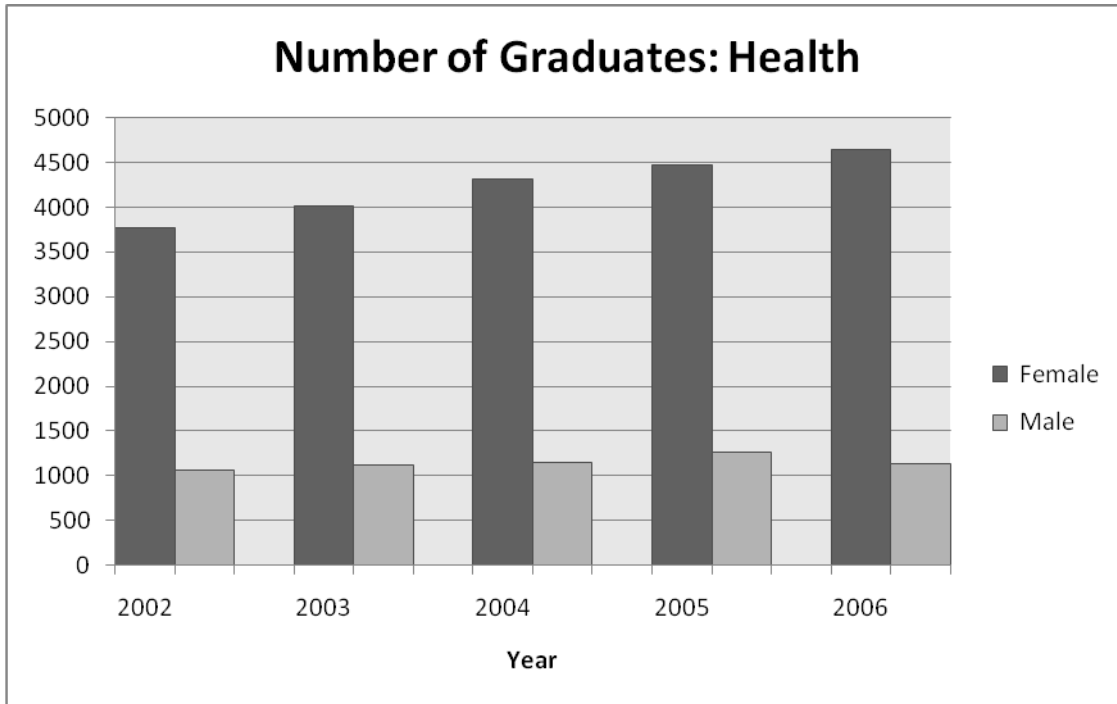




Note: figures in this chart exclude the category 'Other Agriculture, Environmental and Related Studies.'

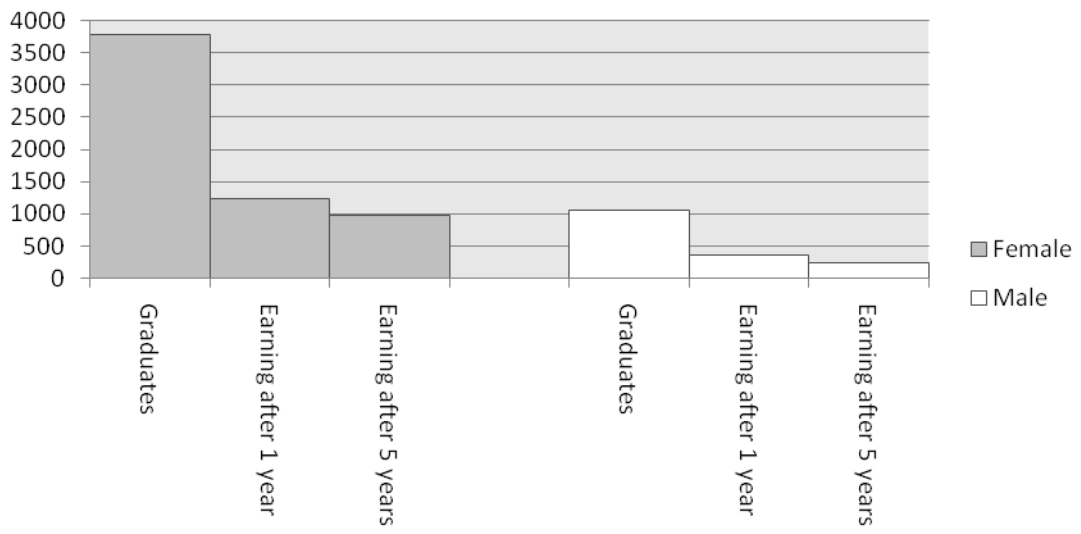
Number of Graduates in Agriculture, Environmental and Related Studies (2002) Earning Income

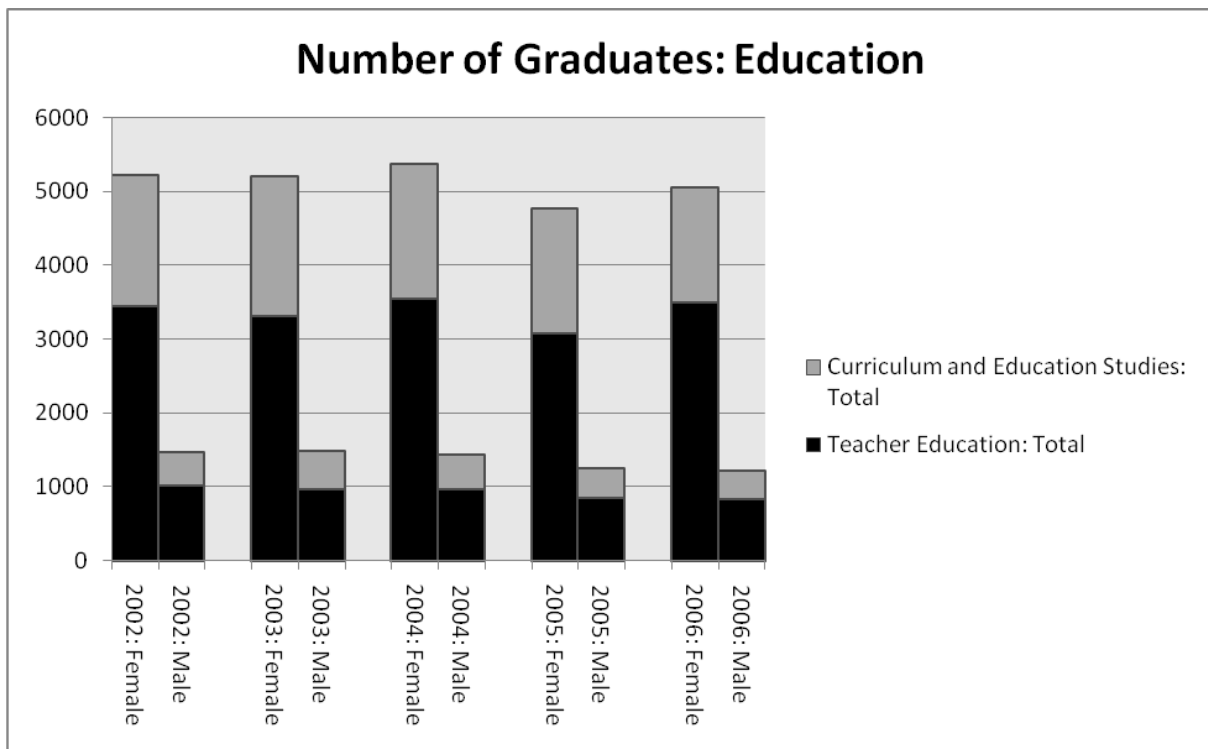
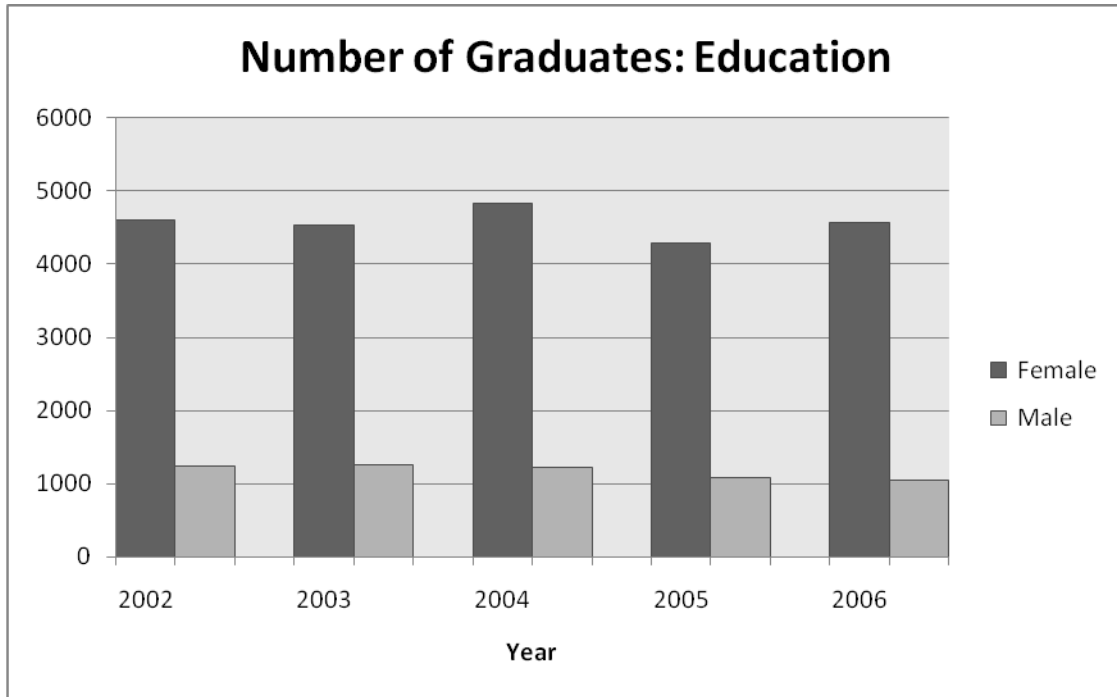




Note: figures in this chart exclude the category 'Other Health.' The category 'Health (Additional): Total' includes Pharmacy, Dental Studies, Optical Science, Veterinary Studies, Radiography and Complementary Therapies.

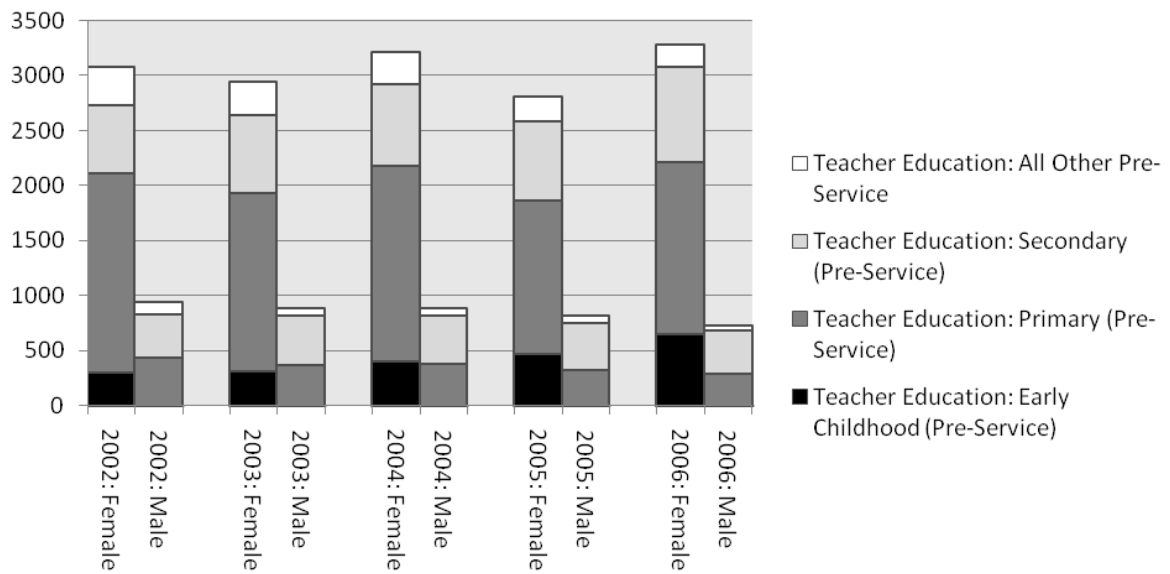
Number of Graduates in Health (2002) Earning Income





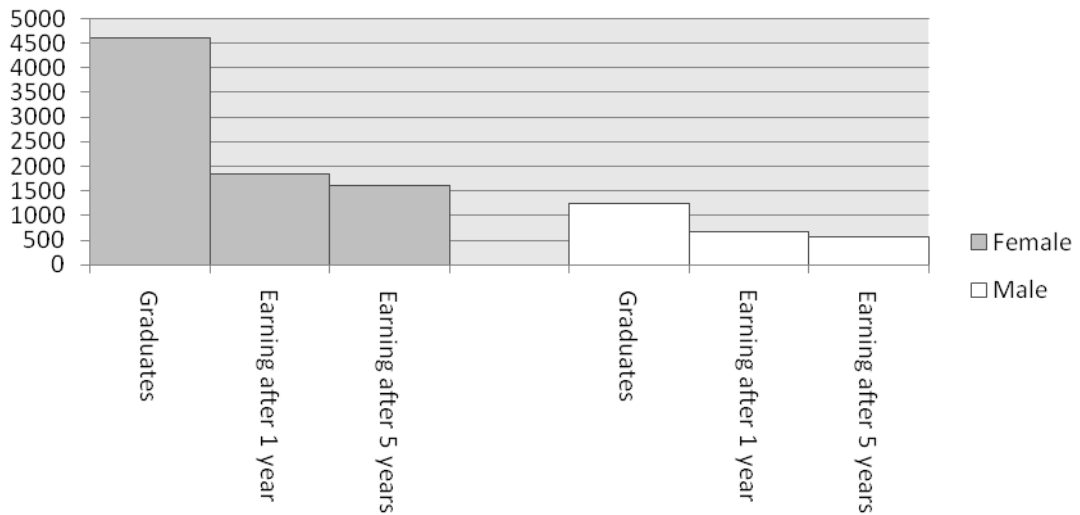
Note: this chart excludes the category 'Other Education.'

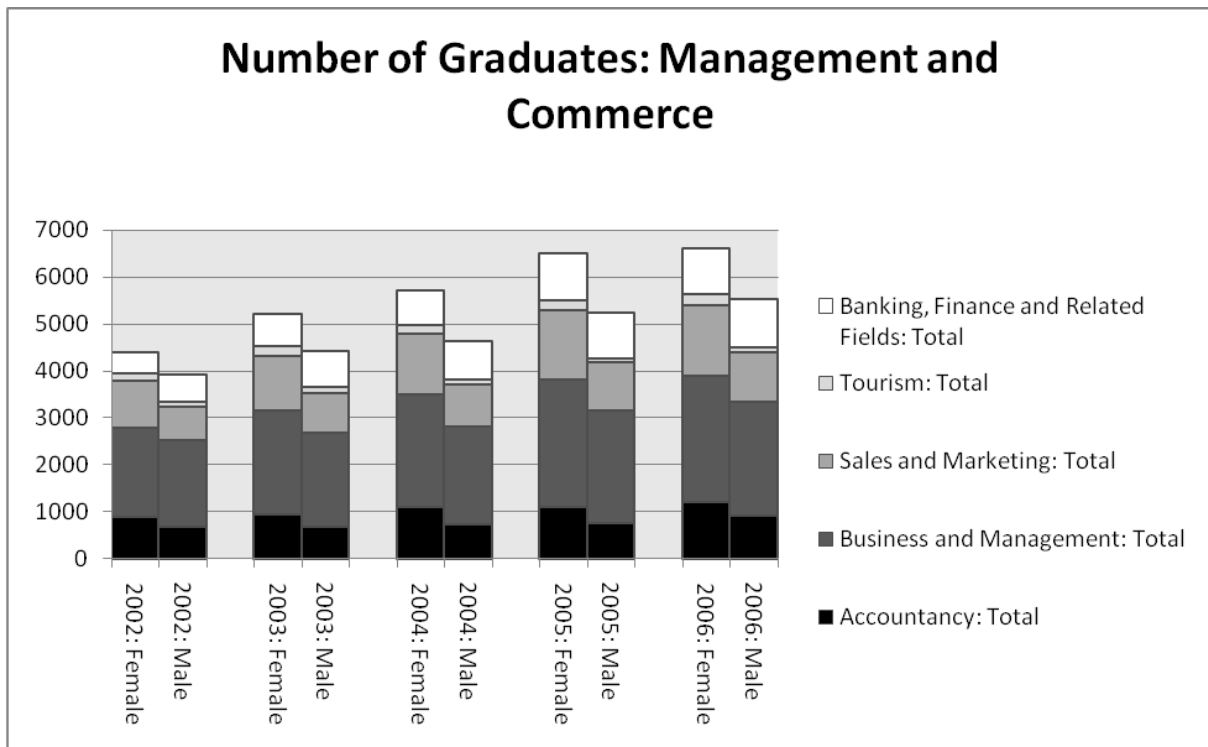
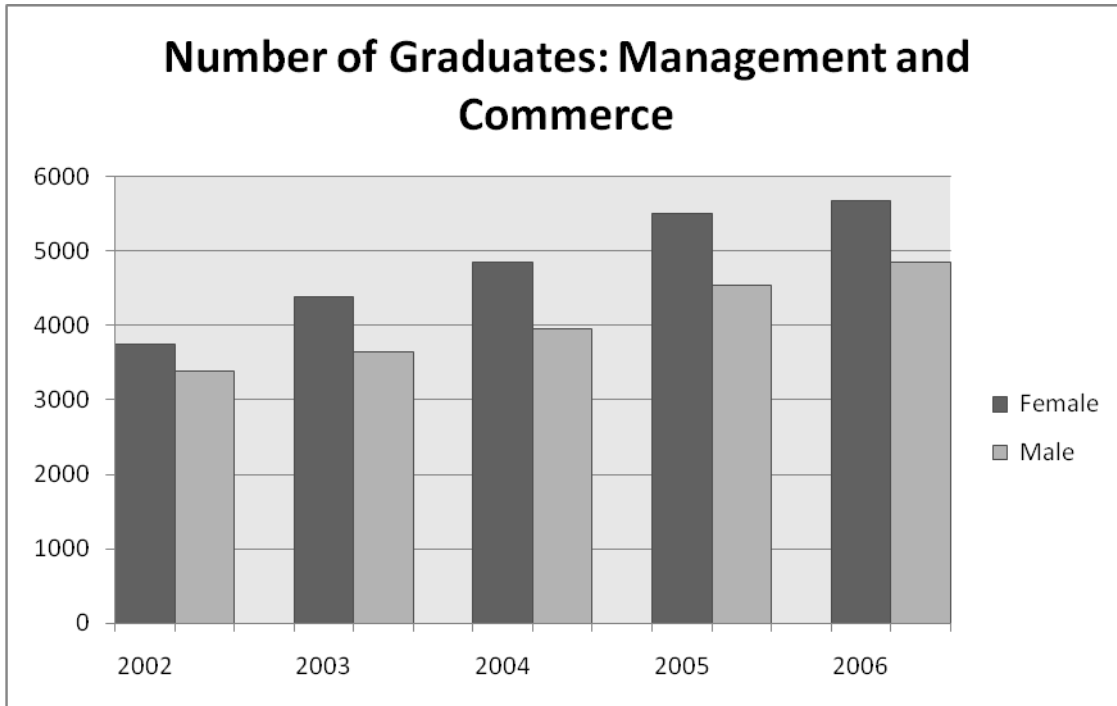
Distribution of Male and Female Graduates: Pre-Service Courses



Note: 'All Other Pre-Service' includes General Pre-Service, Bilingual Primary Teacher Training and Immersion Primary Teacher Training.

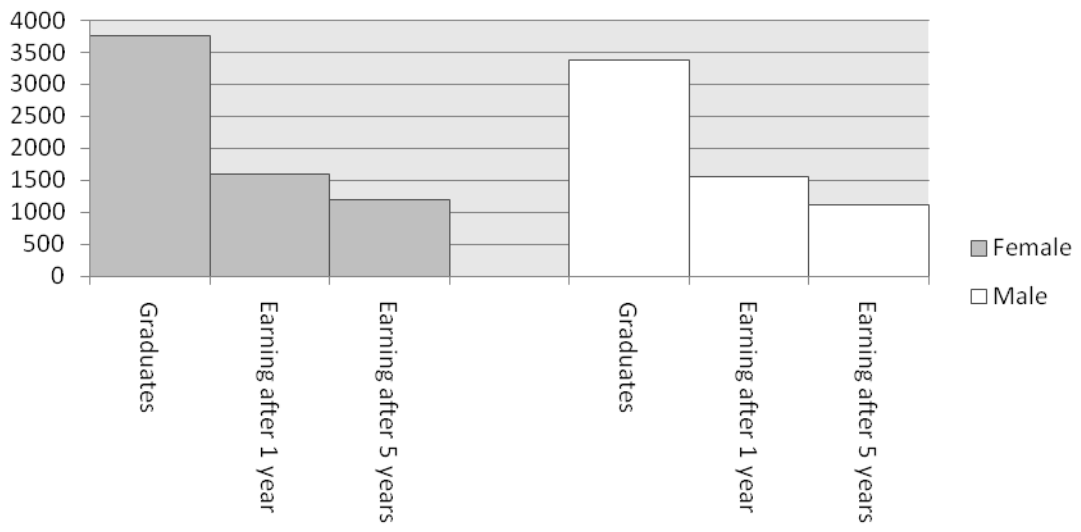
Number of Graduates in Education (2002) Earning Income

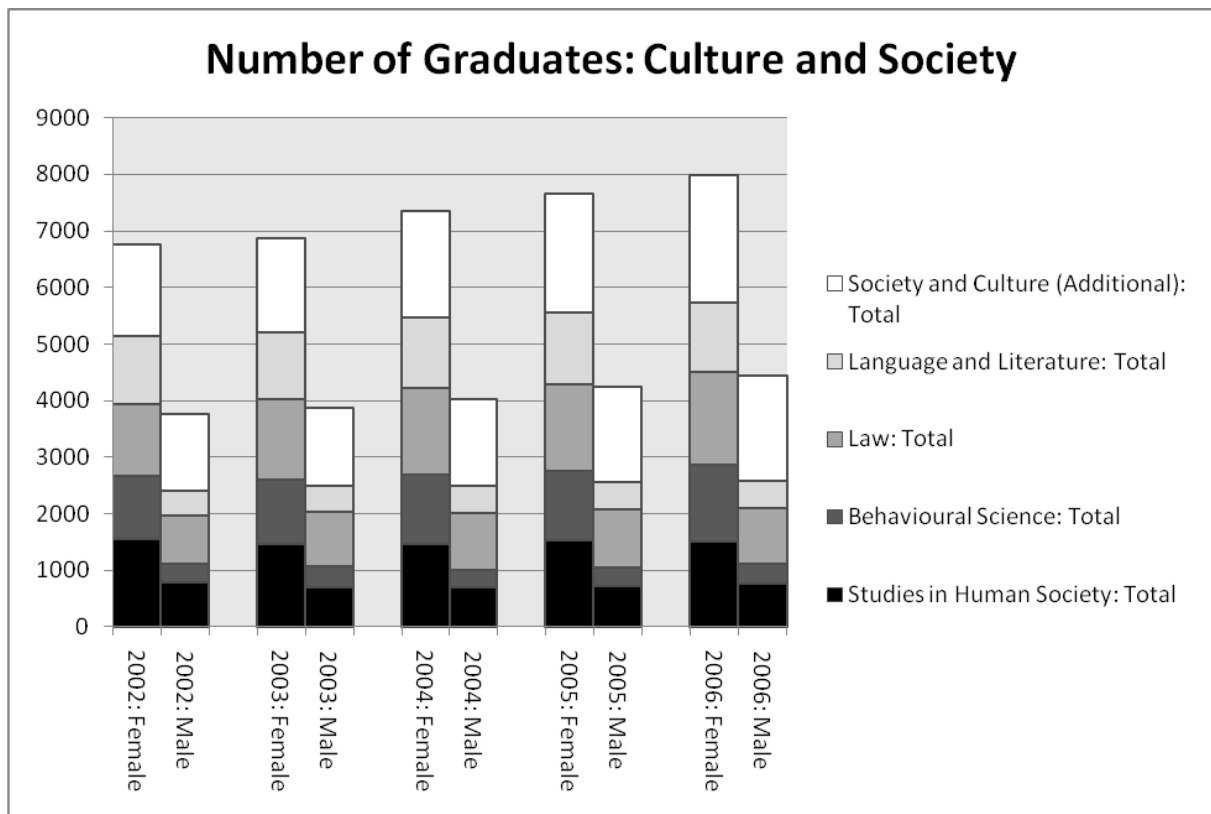
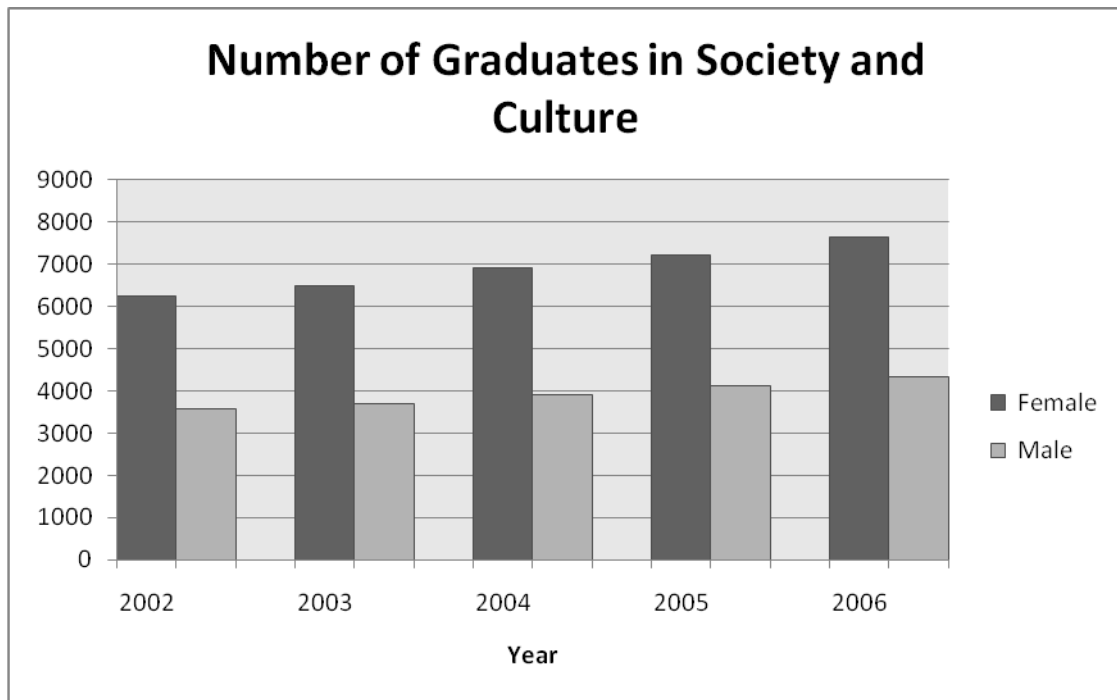




Note: this chart excludes the category 'Other Management and Commerce.'

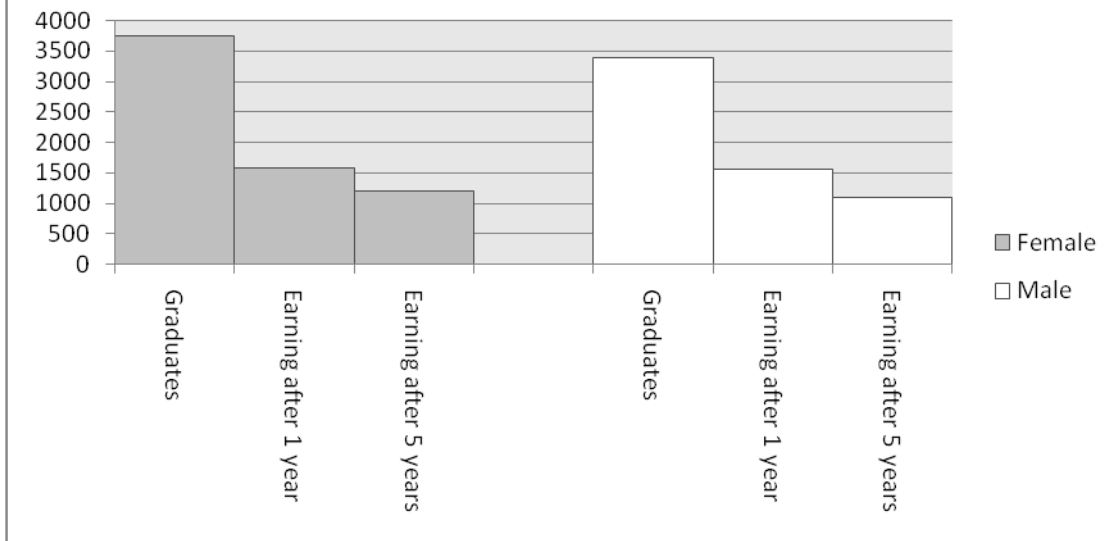
Number of Graduates in Management and Commerce (2002) Earning Income

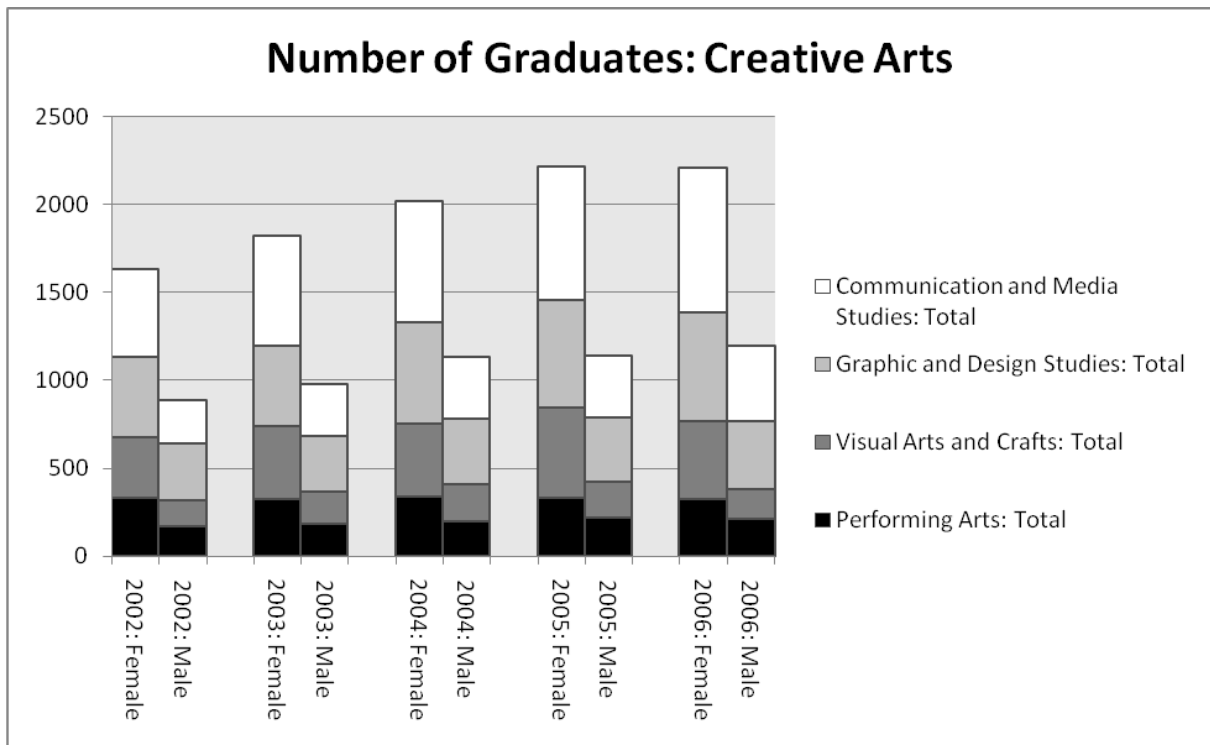
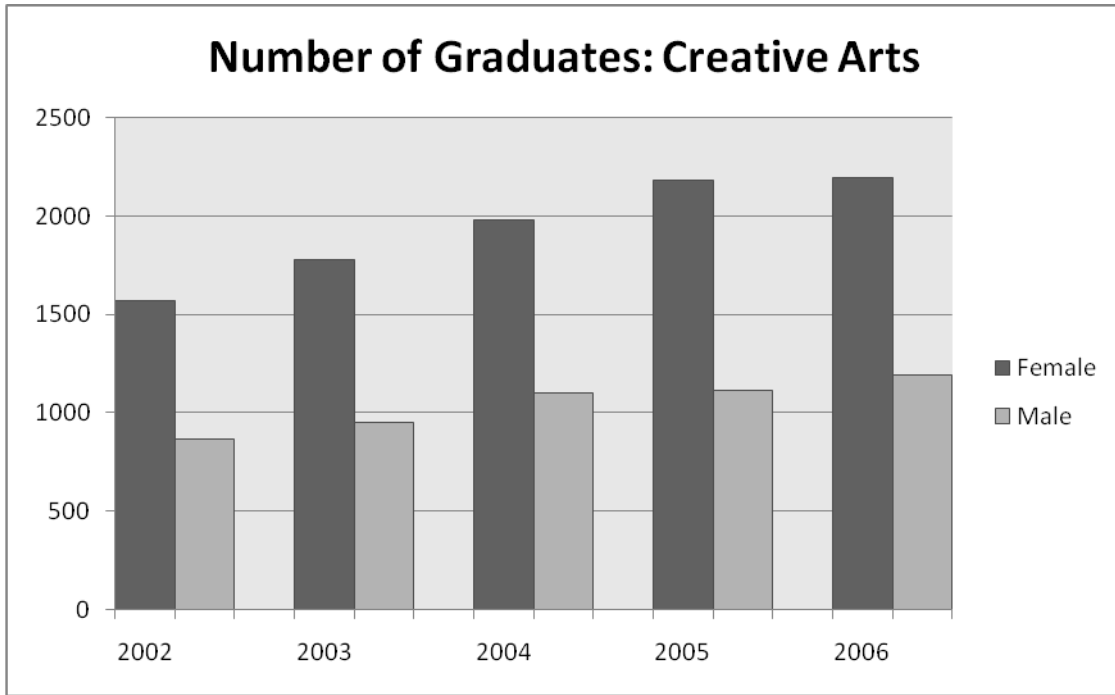




Note: this chart excludes the category 'Other Society and Culture.' The category 'Society and Culture (Additional)' includes Political Science and Policy Studies; Human Welfare Studies and Services; Librarianship, Information Management and Curatorial Studies; Philosophy and Religious Studies; Economics and Econometrics; and Sport and Recreation.

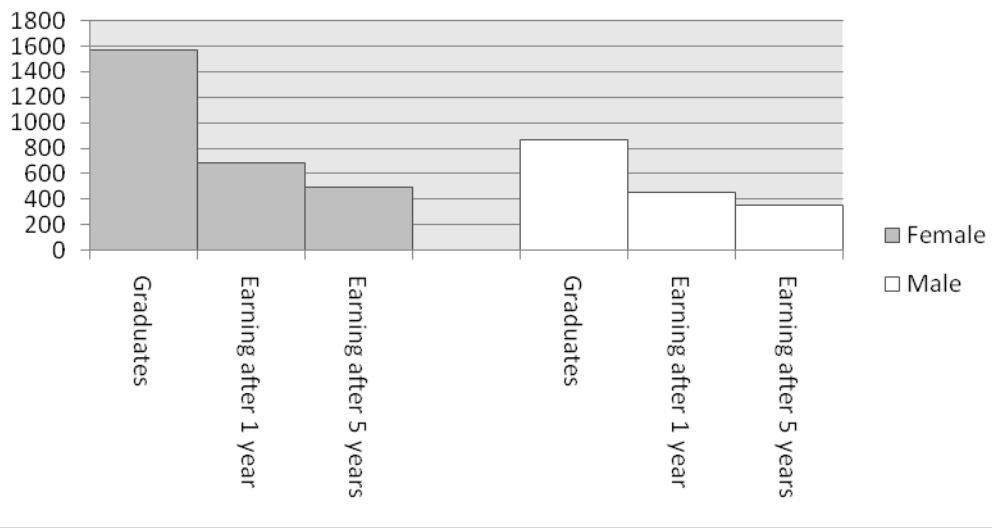
Number of Graduates in Society and Culture (2002) Earning Income





Note: this chart excludes the category 'Other Creative Arts.'

Number of Graduates in Creative Arts (2002) Earning Income



Analysis of Graduate Income Data 2002-2007 by Broad Field of Study

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