

## **The Study of Female College Freshmen in Science and Technology Fields: Their Perception of University Experience**

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### Abstract

Due to the traditional thought and the lack self-confidence in science and technology, few female students choose science and technology subjects as their majors. However, in recent years, as a result of increasing career options in science and technological fields as well as women's status in the society, more and more female students choose science and technology as their majors. Based on this, the purpose of this study was to gain an understanding of female college freshmen in science and technological fields about their university experience, including the reasons to choose the university/college, the subject choices, their perceptions of their life and ability, and aspirations for the future.

The researcher uses Taiwan Higher Education Data System "2005 School Year University Freshman Questionnaire Investigation" as the measurement tool. 3,751 effective questionnaires from female freshmen students in science and technology fields were conducted. The gathered data are analyzed by descriptive statistics, one-way analysis of variance and Scheffe's test.

Keywords: science and technology fields, university experience, female students

## 大專院校科技領域大一女學生大學生涯與現況之研究

### 摘 要

本研究的動機主要是因為女性容易受到「男理工，女人文」的傳統刻板思維與對數理科技缺乏自信心等因素的影響，故選讀科技領域的女學生與選讀人文領域相比，比例偏低，但隨著時代的進步、科技領域就業機會的增加和女性地位的提高，女學生選讀科技領域就讀已呈現緩慢的成長現象。基於此，本研究主要的目的在瞭解大專院校科技領域大一女學生大學生涯，包括選擇學校、選擇科系影響的原因等及對領域的興趣、生活上所面臨的問題和本身能力等的現況。研究者利用台灣高等教育資料庫「94學年度大一新生問卷調查」為研究工具，研究對象為科技領域大一女學生，共計有效問卷3,751份，並將資料以描述統計、單因子變異數分析及薛費法事後考驗等統計方法分析。期能更加瞭解女學生選擇科技領域就讀的經驗。

**關鍵詞：**科技領域、大學生涯、女學生

## **I Introduction**

According to the statistics of Ministry of Education, the number of university female students in the field of science in Year 2006 is 21,667, accounting for 3.38%. When compared to 13,752, or 2.33%, in Year 2001, it shows a big progress has been made. (Department of Statistics, Ministry of Education, 2007a) This means more women have chosen to major in science and technology, areas which have been traditionally occupied by men. Moreover, an analysis conducted by 104 Job Bank in April, 2006 shows that, in contrast to that in April last year, the growth in the application of female graduates for “quality and safety control” vacancies is the most significant, with a rise by 57%, followed by “production and manufacturing” (41%), “software and information management” (39%) and “computer hardware and telecommunication” (32%). (104 Job Bank, 2006)

The purpose of this study is to understand the university experience of female freshmen majoring in science at colleges and universities, including the selection of universities and departments, interest in this field, life troubles and personal capability. The study chooses female freshmen in science and technology department as research object. The data is derived from the “Questionnaire on Freshmen in Year 2005” of the Taiwan Higher Education Data System with a total of 3,751 questionnaires.

The “2005 School Year University Freshman Questionnaire Investigation” of the Taiwan Higher Education Data System is conducted by students via self-completion and self-evaluation in which they answer the questions according to individual situation. As a result, whether or not the female freshmen provided honest answers cannot be confirmed and measure error does exist.

## **II . Literature Review**

### **A. The distribution of university students of both sexes in Taiwan**

Studies undertaken in Taiwan and from abroad found the majority of male students are in the

departments of technology and science, while female students tend to choose social sciences and humanities as their majors. (Stromquist, 1991; Xie & Shauman, 2003; Lin, 2001; Tsai, 2004)

The statistics from MOE, see Table 1, Table 2, Figure 1 and Figure 2, show that from Year 1998 to 2006 most female students majored in social science, business and law.

On the other hand, the departments which are immensely popular among male students are engineering, manufacturing and construction. In terms of percentage of female students, four domains show growth with humanities and arts increasing by 4.76%, service by 2.86%, medical and social welfare by 2.61 and science by 0.94, while engineering, manufacturing and construction leads the downward trend by 5.22%, followed by social science and business and law by 5.03%. However, the proportion of male students in engineering and manufacturing and construction domain has considerably declined year after year. Interestingly, there is an increase in the humanities and arts and service domains for both men and women in recent years.

As shown in Table 1 and 2, the amount and percentage that men and women represent in various domains in Year 2006 are as follows: education (men 16,164, 2.4%: women 28,021, 4.37%); humanities and arts (men 49,816, 7.41%: women 121,357, 18.92%); social science and business and law (men 186,104, 27.68%: women 241,597, 37.66%); science (men 44,684, 6.65%: women 21,667, 3.38%); engineering and manufacturing and construction (men 293,505, 43.65%: women 41,917, 6.53%); agriculture (men 12,998, 1.93%: women 12,480, 1.95%); medical and social welfare (men 34,511, 5.13%: women 121,294, 18.91%); service (men 34,556, 5.14%: women 53,128, 8.28%); others (men 100, 0.01%: women 94, 0.01%). The data suggests the difference between the two sexes is profound. While engineering and manufacturing and construction (293,505 people) take up the majority for men, social science and business and law (241,597 people) account for the majority for women. Although there has been a downward trend for both compared to that in Year 1998, it has not been distinct, suggesting that the

traditional gender stereotype and gender segregation of subject choices between men and women still exist.

Moreover, as shown in Table 3 and Figure 3 and 4, raw data derived from colleges and universities suggests men and women differ remarkably in the 18 discipline between Year 2003 and 2006. The top three disciplines for men are engineering, math and computer science. At the same time, men's number in business and management has showed an impressive growth. Conversely, for women, the most popular subjects are business and management, humanities and medical diagnostic treatment.

The number of people studying in the technology-relevant categories in Year 2006: engineering (men 173,488: women 23,972); math and computer science (men 77,411: women 32,394); natural science (men 20,226: women 10,104). The fact that there are more men in these three categories suggests that technology domain remains dominated by men. When humanities (men 47,914: women 107,081), social science (men 116,238: women 231,257) and technology (men 324,711: women 139,390) are preferred by women. Though the number of women's going into technology world rises by 15,139 compared to that in Year 2003, but the growth is relatively slow when compared to men's amount in the same year, which is 49,922.

Cultural and gender stereotype, influences from parents and teachers, the nature of their study in high schools and employability are all important factors behind students' decision in subject choices. Despite this, a fair amount of women are willing to pursue a career in science and technology.

Table 1 The number of college and university students gathered according to nine major disciplines and gender differences (1998-2006)

Year	Gender	Total	Education	Humanities and Art	Social science	Science	Engineering and	Agriculture	Medical and	Service	Others
2006	M	672438	16164	49816	186104	44684	293505	12998	34511	34556	100
	F	641555	28021	121357	241597	21667	41917	12480	121294	53128	94
2005	M	657700	17623	47046	183483	41757	292464	12939	33292	29047	49
	F	638858	31205	115518	248117	19911	41469	12640	121214	48712	72
2004	M	645213	18029	44957	181064	37981	292575	13326	32242	25003	36
	F	640654	31372	112439	258825	18134	41600	13051	119371	45791	71
2003	M	633069	17992	42672	176100	35804	293172	13793	31802	21698	36
	F	637125	30802	108751	263163	16460	42124	13722	118603	43445	55
2002	M	620172	17562	40272	169809	32280	295108	13513	32317	19286	25
	F	620120	30127	101329	262953	14766	43842	13074	114077	39917	35
2001	M	595851	16877	36606	156198	29859	294860	13433	31200	16807	11
	F	591374	29264	94103	252468	13752	47674	13033	105378	35691	11
2000	M	549217	15021	32359	136187	27387	281873	12970	28812	14608	-
	F	542885	28355	84446	230592	12689	48108	12460	94559	31676	-
1999	M	496573	14012	27554	116267	25228	263076	12537	25949	11950	-
	F	497710	28031	73893	212439	12046	48707	12306	82520	27768	-
1998	M	455039	12609	24112	100114	23132	248020	12211	24584	10257	-
	F	460882	26292	65250	192006	11223	54157	11886	75087	24981	-

Source: Ministry of Education (2007b)- The number of college and university students according to nine major disciplines and sexual differences- Category: education (Statistical index of gender), 2007/12/15, [http://www.edu.tw/EDU\\_WEB/EDU\\_MGT/STATISTICS/EDU7220001/gender/index1.htm](http://www.edu.tw/EDU_WEB/EDU_MGT/STATISTICS/EDU7220001/gender/index1.htm)

Table 2 The percentage of college and university students gathered according to nine major disciplines and gender differences (1998-2006)

Year	Gender	Total	Education	Humanities and Art	Social science and business and law	Science	Engineering and manufacturi ng and construction	Agriculture	Medical Service and social welfare	
2006	M	2.40	7.41	27.68	6.65	43.65	1.93	5.13	5.14	0.01
	F	4.37	18.92	37.66	3.38	6.53	1.95	18.91	8.28	0.01
2005	M	2.68	7.15	27.90	6.35	44.47	1.97	5.06	4.42	0.01
	F	4.88	18.08	38.84	3.12	6.49	1.98	18.97	7.62	0.01
2004	M	2.79	6.97	28.06	5.89	45.35	2.07	5.00	3.88	0.01
	F	4.90	17.55	40.40	2.83	6.49	2.04	18.63	7.15	0.01
2003	M	2.84	6.74	27.82	5.66	46.31	2.18	5.02	3.43	0.01
	F	4.83	17.07	41.30	2.58	6.61	2.15	18.62	6.82	0.01
2002	M	2.83	6.49	27.38	5.21	47.58	2.18	5.21	3.11	0.00
	F	4.86	16.34	42.40	2.38	7.07	2.11	18.40	6.44	0.01
2001	M	2.83	6.14	26.21	5.01	49.49	2.25	5.24	2.82	0.00
	F	4.95	15.91	42.69	2.33	8.06	2.20	17.82	6.04	0.00
2000	M	2.73	5.89	24.80	4.99	51.32	2.36	5.25	2.66	-
	F	5.22	15.56	42.48	2.34	8.86	2.30	17.42	5.83	-
1999	M	2.82	5.55	23.41	5.08	52.98	2.52	5.23	2.41	-
	F	5.63	14.85	42.68	2.42	9.79	2.47	16.58	5.58	-
1998	M	2.77	5.30	22.00	5.08	54.51	2.68	5.40	2.25	-
	F	5.70	14.16	41.66	2.44	11.75	2.58	16.29	5.42	-

Source: Ministry of Education (2007b)- The number of college and university students according to nine major disciplines and gender differences- Category: education (Statistical index of gender), 2007/12/15, [http://www.edu.tw/EDU\\_WEB/EDU\\_MGT/STATISTICS/EDU7220001/gender/index1.htm](http://www.edu.tw/EDU_WEB/EDU_MGT/STATISTICS/EDU7220001/gender/index1.htm)

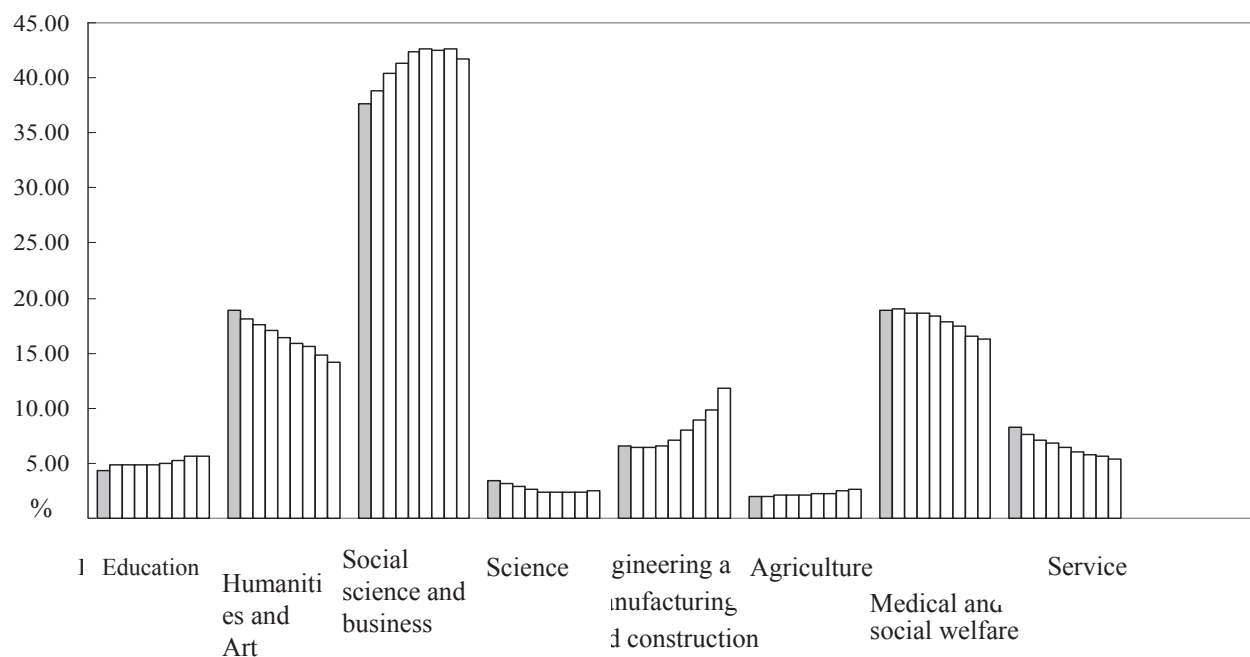


Figure 1 The distribution of college and university female students in nine major domains each year

PS: There are nine bars in each domain, respectively representing the percentage of female students in nine major domains in Year 2006, 2005, 2004, 2003, 2002, 2001, 2000, 1999, 1998 from left to right

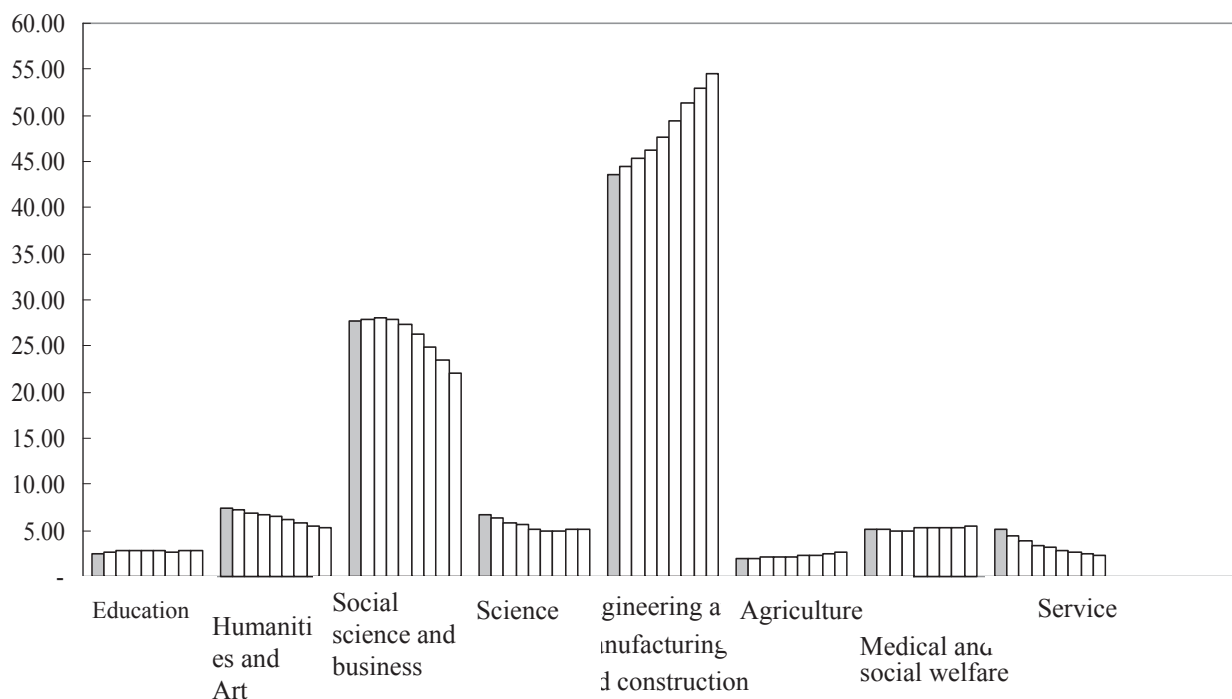


Figure 2 The distribution of college and university male students in nine major domains each year

PS: There are nine bars in each domain, respectively representing the percentage of male students in nine major domains in Year 2006, 2005, 2004, 2003, 2002, 2001, 2000, 1999, 1998 from left to right



Figure 3. Data gathered from colleges and universities according to 18 discipline categories and gender differences (number)

Categories	Year 2003		Year 2004		Year 2005		Year 2006	
	M	F	M	F	M	F	M	F
14 Education Science	8,262	19,85	7,796	18,70	7,060	17,43	5,230	13,423
18 Fine and Applied Arts	6,406	14,86	7,496	16,70	8,655	18,63	10,065	21,137
22 Humanities	19,12	57,20	21,14	60,80	22,39	63,22	23,509	65,818
30 Social & Psychological Science	12,04	21,29	12,41	21,86	12,81	21,88	13,314	22,515
34 Business and Management	65,47	131,1	70,50	138,3	74,15	140,1	77,036	139,193
38 Law & Jurisprudence	6,124	5,979	6,426	6,547	6,791	7,100	7,025	7,495
42 Natural Science	16,91	7,213	17,97	8,541	19,00	9,093	20,226	10,104
46 Math & Computer Science	57,44	28,53	65,118	31,04	72,56	31,88	77,411	32,394
50 Medical Diagnostic Treatment	22,36	42,29	23,19	44,18	24,26	46,44	25,252	47,535
52 Craft & Industry	754	199	804	126	868	38	682	14
54 Engineering	152,7	22,32	162,3	23,65	169,6	24,06	173,488	23,972
58 Architecture Town-planning	7,298	4,525	7,394	4,861	7,649	5,210	7,903	5,660
62 Agriculture, Forest & Fishery	10,17	10,79	10,09	10,61	10,29	10,64	10,588	10,506
66 Home Economics	3,311	29,70	3,329	31,40	3,639	33,44	3,905	34,443
70 Transportation & Communication	4,985	3,329	5,771	3,795	6,694	4,109	7,045	4,316
78 Service Trades	4,641	11,604	5,823	13,72	7,496	16,10	9,147	18,086
84 Mass Communication	6,179	11,997	6,895	12,81	7,538	13,70	7,927	14,414
85 Physical Education and Others	6,258	4,249	7,087	5,168	7,965	5,915	9,110	6,703
<b>Triad Division:</b>								
Humanities	40,05	96,16	43,52	101,3	46,07	105,2	47,914	107,081
Social science	95,62	206,7	103,2	219,8	110,24	227,4	116,238	231,257
Technology	274,7	124,2	294,7	131,6	313,2	136,4	324,711	139,390

Source: Department of Statistics under Ministry of Education (unknown date)- Rough data gathered from colleges and universities, 2007/12/15, Website:  
[http://www.edu.tw/EDU\\_WEB/EDU\\_MGT/STATISTICS/EDU7220001/project.htm](http://www.edu.tw/EDU_WEB/EDU_MGT/STATISTICS/EDU7220001/project.htm)

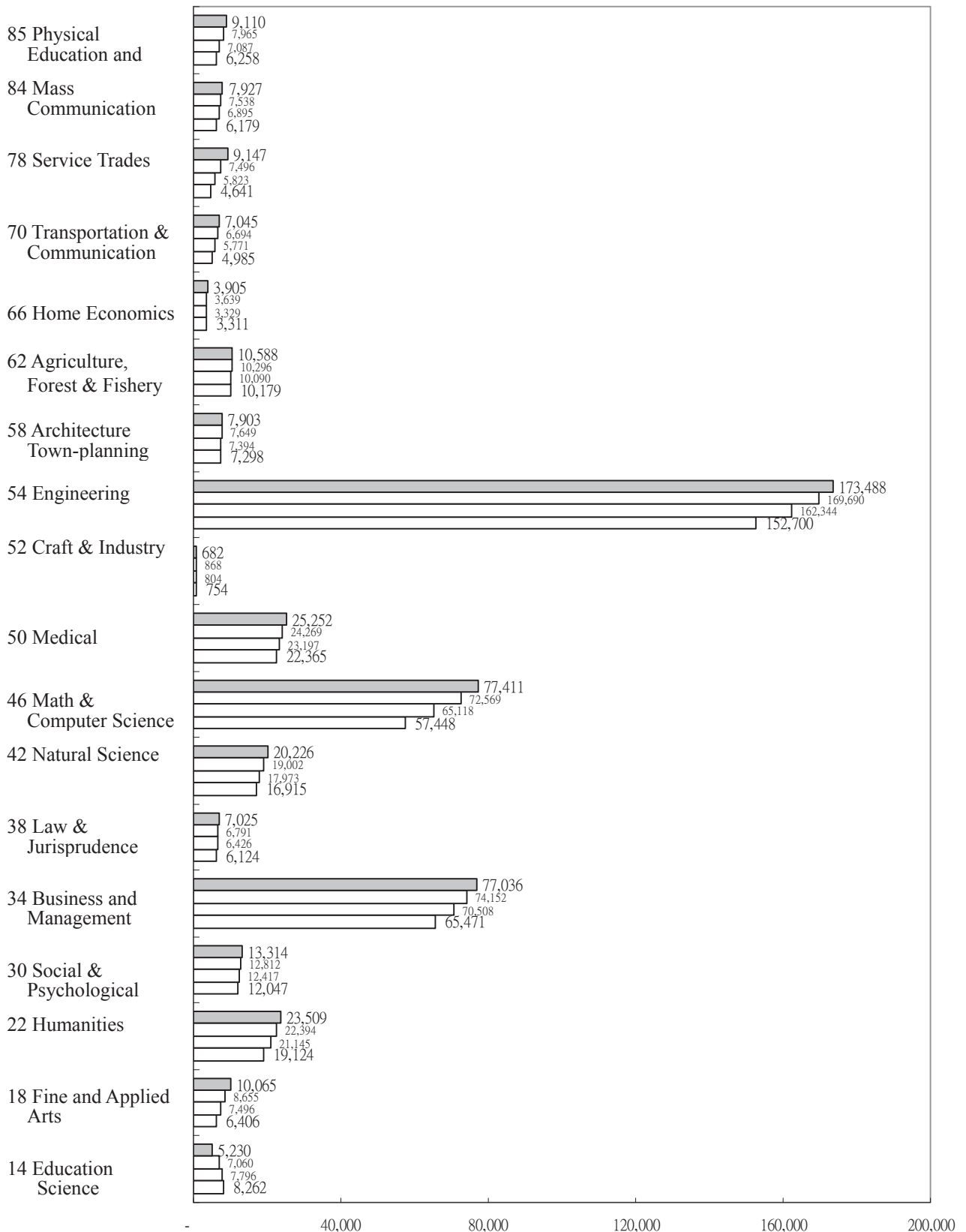


Figure 3 The distribution of the number of college and university male students according to 18 discipline categories between Year 2003 and 2006

PS: There are four bars in each category, respectively representing the distribution of the number of male students in 18 discipline categories in Year 2006, 2005, 2004 and 2003 from top to bottom

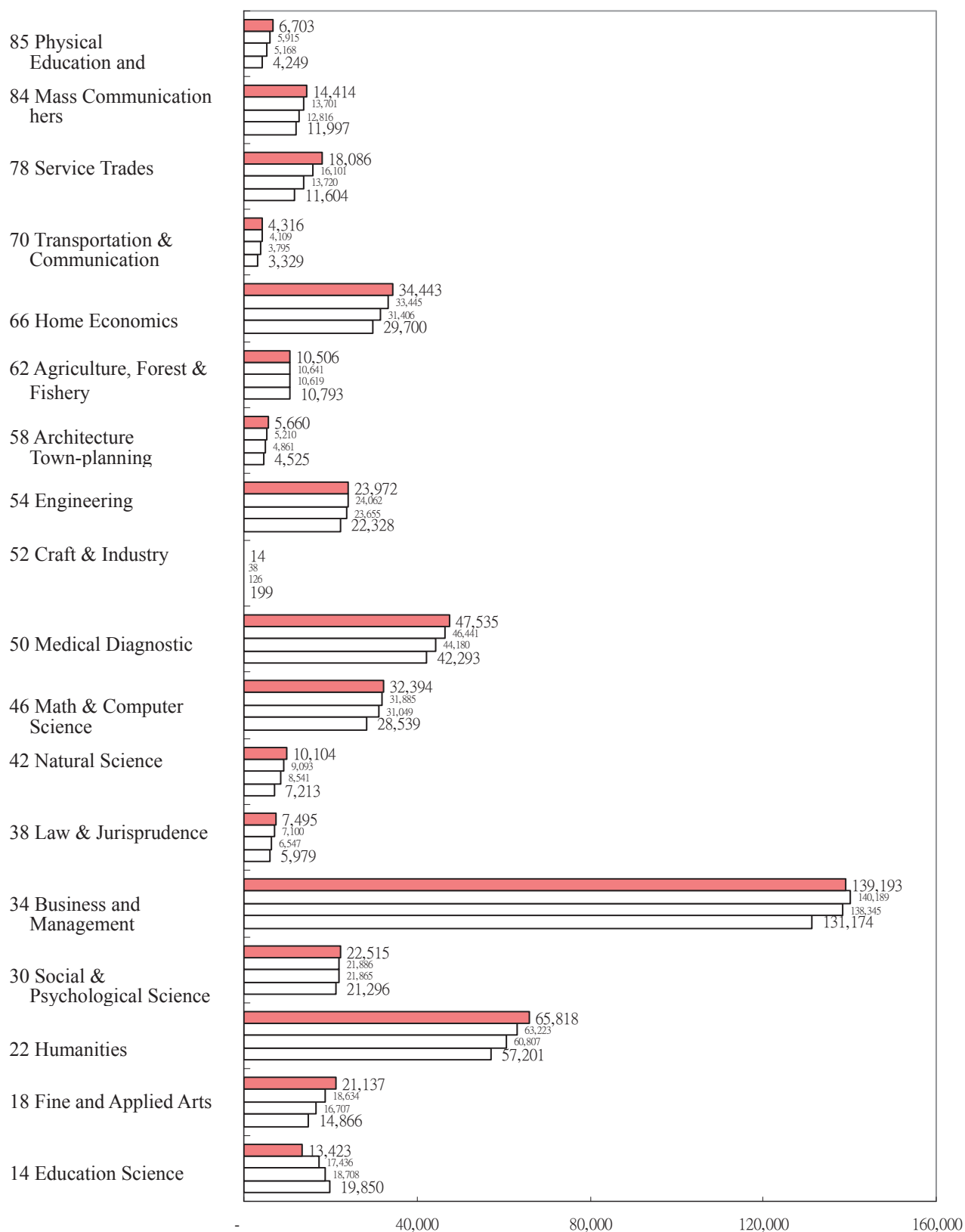


Figure 4 The distribution of the number of female university students according to 18 discipline categories between Year 2003 and 2006

PS: There are four bars in each category, respectively representing the distribution of the number of female

students in 18 discipline categories in Year 2006, 2005, 2004 and 2003 from top to bottom

## **B. Women vs. science and technology**

### **Gender stereotyped and the choice of subject majors**

Researches conducted in Taiwan indicate that women's performance on natural science is relatively unsatisfactory compared to men's. Furthermore, study results show both men and women consider men are more talented in learning science (Cheng, 2002). In Taiwan, profession stereotype is still common and women are stereotyped by the society to study in what they have been expected. (Hsieh, 1995, cited in Hawkins, 1985) Apart from gender stereotype, as the choice of major at universities is usually relevant to future employment, many studies has found that male students tend to stay in technology and science disciplines, whereas the majority of women choose humanities. (Stromquist, 1991; Xie & Shauman, 2003; Lin, 2001; Tsai, 2004) According to the ratio of nine major areas of study in colleges and universities in Taiwan, women mostly major in social science, business and law. By contrast, men prefer engineering, manufacturing and construction.

Hsieh, Chen and Lin (2007) found the choice of subject major is resulted from the interplay of traditional gender frame, the influence from the significant others, the nature of a discipline and employability. In her investigation into female seniors in the field of electronic engineering and female professors in Taiwan, Fang (2006) reveals that most women's choice of science have faced serious objections from their family members and teachers. Nonetheless, due to the change of social values along with the rise of feminism, there is less disapproval from parents and teachers nowadays. Teachers even encourage girls to study science. This change is partly related to the current examination system. There prospect of university admission is better for students who major in science and technology.

Many reports indicate that women's choices of majoring in science and engineering can be

attributed to the personal, family and society factors. In the personal factors, it can be related to their interests, hobbies, learning ability, performance in the score and the degree of education. In the family factors, viewpoint from the parents and the personal opinions both matter a lot. Needless to say, the expectation of gender roles in the society is also very important. To women, marriage and motherhood affect the personal preference toward the female oriented profession and to choose the career that enables them to manage both work and family (Stromquist, 1991 ; Xie & Shauman, 2003 & Chu, 2000).

Other researches have shown that some professions, such as doctors, professors, engineers, are still seen as male professions, Even with more women entering those fields, it has not changed people's image about these professions. On the other hand, nurses, teachers, secretaries are seen as more suitable for women (Kelly & Colangelo, 1991). Lightbody (1995) investigated first-year students in the Scottish universities and discovered that during the mid-1990, the numbers of female students in law and medicine disciplines had been increasing and outnumbered male students. The research discovered the reasons for female students choosing medicine and law are because these jobs would allow better chance of interaction with people and a high degree of participation in society. This is the proper social role recognized by female students. Chevalier's (2002) research also shows that the bias in the choice of major is associated with some 'typically female' character traits, such as being less ambitious and workaholic and caring more for others.

Stromquist (1991) used the sample of 759 undergraduates, graduates and foreign students of ten universities in United States to study how personal, family and social factors influence the female students in choosing the non conventional subjects. The study investigates what factors affect them to choose non conventional fields. Stromquist has the following discoveries: 1. salary is the main reason for female students choose nonconventional subjects. 2 the chance of admission for entering the non conventional departments is linked to their performance of

mathematics and physic in high schools. 3 The influence from parents is also significant. Fathers with higher level of education support daughters to choose the non conventional subjects more. 4 the opinions of parents, relatives, friends and peer groups also matters a lot. 5 women prefer their future career could fit in both of the social roles in marriages as well as motherhood. 6 Subject teachers from high schools generally do not encourage students entering the non conventional fields. Although the influence from counsellors is less obvious, counsellors support students more to choose non conventional subjects. The significance of her finding is that although the female students in nonconventional subjects perform as good as their male counterparts in mathematic and physics, they do not have high commitment about their future work like the male. Instead, they tend to identify with the traditional values and put husbands' need as their priority. For these women, marriage and family responsibilities matter more than the pursuit of career. (Stromquist, 1991)

### **Women working in the fields of science and technology**

An extensive statistical survey of women employed in research in France shows that women work predominantly in a limited fields of research such as life sciences, chemistry, medicine, humanities and social sciences (Bonneau & Gordon, 2002). Xie & Shauman (2003) adapted the life course study and studied the cause of fewer female scientists and engineers. The study discovers that even though female high school students have performed as good as male students, few chose to major science and engineering in universities. Thus, there are fewer women in science and engineering departments in the universities and also fewer women in related careers.

Blickenstaff (2005) have reviewed the literatures in the field – trying to understand why women choose to leave STEM (science, technology, engineering and mathematics) careers. He has summoned up the main explanations from most scholars: 1. biological differences between men

and women; 2. girls lack of academic preparation for a science major/career; 3. girls' poor attitudes toward science and lack of positive experiences with science in the childhood; 4. the lack of female scientists as role models; 5. science curricula are irrelevant to many girls; 6. the pedagogy of science classes favors male students; 7. a 'chilly climate' exists for girls/women in science; 8, cultural pressure on girls/women to conform to traditional roles; 10, an inherent masculine worldview ub science epistemology.

Due to these reasons, it shows that the importance of university experience for female students in science and technology should be carefully studied. Even if these women have chosen nonconventional paths, it is important to carefully examine their experience and ensure that they can be better supported. In so doing, more women would be encouraged to stay in the fields and have better career development in the future.

It can be assumed that the first year in higher education is a very key stage for freshmen. What they have experienced during the first year would surely have a significant impact on their actions for the following 3 years of study and even future career development. This is not to say that their values and attitudes towards their study and life would not have significant changes after the first year.

For this purpose, this study specifically looks at the experience of female freshmen in science and technology fields. By gaining better knowledge about these women's values and perception, it is expected that they can be better supported and further in-depth research can be conducted in Taiwan in the near future.

### **III. The Methodology**



## **B. Study Tools**

This research adapts the questionnaire of first grade university students of 2005 from Taiwan Higher Education Data System. The content of the questionnaire is divided into four sections:

1. Your high school experience 2.The experience of choosing university and majors, 3. current condition – their perceptions of university life 4.background information. This research eliminates the section of the experience of high school and adapts the three sections of the experience of university, perceptions of university life, and background information.

## **C. Data Analysis**

This research analyzes the data with the statistic software package SPSS10.0 and the statistic methods cover the followings,

1. Descriptive Analysis: This study adapts the sequence distribution and the percentage to understand the structure of the sample and adapts the average and deviation to understand the current condition of the university students.
2. One-way Analysis of Variance: testing the variance of the factors of the experience from university and the current condition of the first grade college female students taking science subjects from their various backgrounds.
3. Post Hoc (Scheffe) Comparison: After the One-way Analysis of Variance, if the value of F reaches to the significant level, the post hoc comparison will be further analyzed to understand the variance.
4. The significant level of hypothesis under this research is set as  $\alpha=0.05$ .

## **IV. Result and discussion**

### **A. Data Analysis**

This research adapts the questionnaire of the first grade university student of 2005 from Taiwan

higher education database. The test period is from October 2005 till February 2006. By taking out of the invalid questionnaires and the questionnaires form non science students and male students, there are total 3,751 questionnaires.

The total valid sample questionnaires are 3,751 pieces. Most types of colleges are the private colleges and universities, 1,247 samples and are 33.2% of total. Most subjects taken are mathematics, computing subjects, 1,472 samples and are 39.2% of total. Most education of their fathers is high school degrees, 1,288 samples and is 34.3% of total. Most education of their mothers is high school degrees as well, 1,388 samples and is 37.3% of total. Most ranges of family annual income are the income less than NT\$ 500,000, 1,892 samples and are 50.40% of total. The population distribution of the valid samples is listed as Table 4.

Table 4: The valid samples of the female college students taking the science subjects

<b>Variable Statistic</b>	<b>Types</b>	<b>Quantities</b>	<b>Valid (%)</b>
<b>Population</b>			
	Types of college		
	Public University	977	26.0%
	Public College	406	10.8%
	Private University	1121	29.9%
	Private College	1247	33.2%
Subjects	Nature Science	846	22.6%
	Mathematic and Computing	1472	39.2%
	Engineering	1433	38.2%
Father's Education	Elementary school or under	453	12.1%
	Secondary School	795	21.2%
	High School and equivalent	1288	34.3%
	College	564	15.0%
	University	504	13.4%
	Graduated School and above	147	3.9%
Mother's Education	Elementary school or under	602	16.0%
	Secondary School	829	22.1%
	High School	1388	37.0%
	College	478	12.7%
	University	375	10.0%
	Graduated School and above	79	2.1%
Family Income	Less than NT\$ 500,000	1892	50.4%
	NT\$500,000 – NT\$ 1,140,000	1336	35.6%

NT\$ 1,150,000 – NT\$ 1,500,000	348	9.3%
NT\$ 1,510,000 – NT\$ 3,000,000	129	3.4%
NT\$ 3,010,000 – NT\$ 5,000,000	31	0.8%
NT\$ 5,010,000 and above	15	0.4%

## **B. The University Experience: Analysis of female students taking science and technology subjects**

In the general questions of the experience from university and current condition of university students, the average score of each question is 2.7. The score of each factor influences the decision of selecting university, subjects and courses. The details are stated as Table 6. In the general condition question, the average score is 2.57. The scores of each factor in order are goal, personal ability, interest field, personal opinion. The details are stated as Table 6. More details of each factor will be discussed later.

Table 5. The average score of university choices (including subject and course choices) of the female university student majoring science and technology

<b>Factors</b>	<b>Average</b>	<b>Deviation</b>	<b>No. Of Questions</b>	<b>Average score of each question</b>
University choices	42.09	6.38	15	2.81
Subject choices	30.64	5.00	11	2.79
Course choices	29.91	6.28	12	2.49
General experience from	102.64	14.69	38	2.70

N=3751

Table 6. The average score of perception about current condition from female freshmen majoring science and technology

<b>Factors</b>	<b>Average</b>	<b>Deviation</b>	<b>No. Of Questions</b>	<b>Average score of each question</b>
Goal	23.84	4.53	8	2.98
Personal Ability	22.02	4.65	8	2.75
Area of Interests	32.02	5.51	12	2.67
Personal Opinion	60.52	5.65	24	2.52

Overall View and Opinions	138.40	13.06	52	2.66
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N=3751

### (1) Factors related to the choice of the university

In the factors of the experience from university for choosing the university, the female university students score each question between 2.09 and 3.32. The deviation is between 0.69 -0.93. See table 7. From the result of this study, the selection of subject is the most important factor to decide the university selection. The consideration of career, the score of examination and style of the university are more important than other factors. The other factors such as the distance from home, having other special case (talent classes, no specialization in the first grade etc), having friends studying in the same school etc are less important. Therefore, it is obvious that the career development is more important factors in selection of university and subject than the factors such as the reputation of the university, suggestion from teachers and parents, etc.

Table 7 the important factors in order about choices of university

Structuring items and content for university selection	Average	Deviation	Orders
12. Subject consideration	3.32	.69	1
14. Career development	3.17	.74	2
15. The score of entrance examination	3.09	.77	3
11. The culture of the university	3.09	.73	4
04. The reputation of university	2.99	.73	5
08. The environment, equipment and facility in the university	2.99	.76	6
10. The teachers in the university	2.98	.77	7
01. The influence and suggestion from parents and family	2.97	.74	8
13. Financial concern (Tuition, scholarship, accommodation fee)	2.93	.82	9
02. The influence and suggestion from teachers	2.83	.74	10
03. The influence and suggestion from friends, classmates or peer group	2.75	.71	11
06. Near home	2.50	.93	12
05. Far away from home	2.22	.89	13
09. Special Case (talent class, non specialization in the first year of study)	2.18	.78	14

## (2) Factors related to the choices of their major

For factors related to their major, the average score of each question is between 2.01 and 3.27. The deviation is between 0.72 and 0.93, see Table 8. From the result of this study, the personal interest is the most important factor. The factors such ability in the subject or work, the career development opportunity are more important factors. The factors of scholarship, preference of the university (for entering the university) etc are less important. Therefore, it is obvious that the personal interest, ability in the subject, work opportunity and career development are more important factors for female university student in selecting the subject. The personal factors and social factors have more influence on these female students' major. The related research has the similar conclusion (Hsiao, 2006; Fang, 2006).

Table 8 The factors for their choices of subject majors listed in order.

Structural items and content for subject selection	Average	Deviation	Orders
04. Personal interest	3.27	.75	1
05. Personal ability in the subject	3.16	.72	2
10. Job opportunity	3.16	.75	2
09. Potential of career development	3.07	.76	4
11. Performance in entrance examination	2.94	.82	5
01. Influence and suggestion from parents and family	2.82	.80	6
02. Influence and suggestion from teachers	2.73	.78	7
03. Influence and suggestion from friends, classmates or fellow	2.63	.75	8
06. Related subjects studied in the high school	2.57	.93	9
07. Scholarship	2.27	.83	10
08. To enter a particular university (no concern for subject choices)	2.01	.87	11

## (3) The factors for course selection

For factors of the female university students in course options, the average score of each

question is between 1.91 and 3.22. The deviation is between 0.81 and 1.02, see Table 9. From the result of this study, the personal interest is the most important factor for students in choosing courses. The factors such the reputation of teachers and timetable of the subject are also important factors. Tutors, BBS discussion, male classmate (including male fellow student) are less important factors. Therefore, it is obvious that the factors of personal interest, reputation of teachers, the timetable of the subject are more important for female university students in selecting the course. The factor of having male classmates is the least important one.

Table 9 The factors for their choices of course listed in order

<b>Structural items and content for course selection</b>	<b>Average</b>	<b>Deviation</b>	<b>Orders</b>
08. Personal interest	3.22	.81	1
07. The reputation of teachers	2.98	.86	2
06. The timetable of the course	2.90	.89	2
11. The content and practical of the course	2.84	.85	4
05. Easy to pass it	2.77	.91	5
12. Personal course planning (such as changing the subject,	2.69	.95	6
10. Outlines of the course on the website	2.39	.86	7
04. Female classmate (including female seniors)	2.12	.88	8
01. family members (such as parents, brothers and sisters)	2.11	1.02	9
02. Tutors	1.98	.89	10
09. BBS discussion	1.98	.88	11
03. Male classmates (including male seniors)	1.91	.85	12

#### **(4) Their areas of interests**

For factors of the female university students about the interest areas, the average score of each question is between 2.17 and 3.16. The deviation is between 0.75 and 0.96, see Table 10. From the result of this study, the interest field of female university student is most toward to interacting with different types of people They have the high interest in writing, drawing,

performance and playing musical instruments and less interest in operating machinery, electrical and carpentering tools and less interest in repairing electrical appliances, furniture and fixing water and electrical issues. It shows that these female university students are more interested in interpersonal relationship as well as writing, drawing, performance and playing musical instruments.

Table 10 The priority for their area of interests listed in order.

Structural items and content for interest	Averag	Deviat	Orders
07. Interact with different types of people	3.16	.75	1
05. Writing, drawing, performance and playing musical instruments	3.12	.84	2
06. Work involved with creativity	3.05	.80	2
08. Help other people's worry	2.99	.78	4
09. Lead and supervise other people	2.67	.81	5
11. Organize the complicated data and document	2.59	.83	6
03. Study the course, book or magazine about mathematics, biology, physics and chemistry	2.58	.96	7
12. Record detail items and filing	2.56	.81	8
10. Persuade people to follow my instruction	2.48	.81	9
04. Use mathematics to solve practical problems	2.39	.92	10
01. Operate machinery, electrical and carpentering tools	2.26	.87	11
02. Repair electrical appliances, furniture and fixing water and electrical problems	2.17	.81	12

### **(5) Their perception of their ability**

As to their perception of their ability, the average score of each question is between 2.29 and 3.15. The deviation is between 0.84 and 1.01, see Table 11. The result shows they perceive they are better at interpersonal relationship (communication and co-working) and follow with the ability of analysis and art. These female students see their abilities of English reading, listening and speaking as in need of improvement.

Table 11 The female students' perception about their ability listed in order.

<b>Structural items and content for abilities</b>	<b>Average</b>	<b>Deviation</b>	<b>Orders</b>
4. Interpersonal relationship (communication and co-working)	3.15	.84	1
8. Analysis	2.94	.88	2
1. Art	2.89	1.00	2
3. Oral Expression	2.84	.92	4
2. Leadership	2.81	.92	5
7. Mathematic and Logic	2.68	1.01	6
6. English reading	2.43	.96	7
5. English listening and speaking	2.29	.96	8

### **(6) Their perception of their goals in life**

As to the goal of these female students, the average score of each question is between 2.42 and 3.45. The deviation is between 0.71 and 0.98, see Table 12. The results show that the goal of having a good family is the most important thing for these women. The goal of having a good spiritual life and having high level of foreign language proficiency rank the second and the third. However, having contributions to the society and being influential in the society are less important for these women.

Table 12 The goals of female students in their first year

<del>1. To become a expert</del>	2.82	.91	6
<b>Structural items and content for abilities</b>	<b>Average</b>	<b>Deviation</b>	<b>Orders</b>
<del>2. To have special contribution to the society</del>	2.76	.88	7
5. To have a good family	3.45	.75	1
4. To be influential in the society	2.42	.98	8
<del>7. To have a good quality spiritual life</del>	3.34	.71	2
8. To have the high level of foreign language proficiency	3.13	.83	2
3. To have a own successful business	3.00	.85	4
6. To have a prosperous material life	2.91	.83	5



### **(7) Whether they have majored in the areas of their interests**

When asked whether they have majored in the areas of their interests, 557 students answer their current majors 'fit very well' with their original plan, 1,724 students answer 'fit', 1162 students answer 'not fit' and 308 students answer 'not fit at all', see Table 13. More than half female students agree that the current majors are their favorites. As showed in Table 8, personal interest is the important factor for their subject choices, it is not surprising that more than half of the respondents feel that they have majored in the areas of the interests.

Table 13 Whether their majors fit well with the areas of their interests

<b>Items</b>	<b>Numbers</b>	<b>Percentage</b>
Fit very well	557	14.4%
Fit	1724	44.6%
Not Fit	1162	30.0%
Not Fit at all	308	8.0%
Missing Answers	117	3.0%
Total	3751	97.0%

### **(8) Their current plan**

The plan for the female student during their university study cover: taking a minor (1891 replies of yes, 50.4%), doing research project (2183 replies of yes, 58.2%), preparing the certification exam or civil servant examinations (2700 replies of yes, 72.0%), preparing the examinations or preparing for further study in graduate schools (2480 replies of yes, 66.1%), see Table 14. The result of this study shows that most female university students in science and technology fields have priorities in gaining more certifications and qualifications, taking civil servant examinations, preparing for examinations or further study in Taiwan. For them, pursuing further study and the preparation for employment are their major concerns.

Table 14 Their Current Plan

<b>Plan</b>	<b>Yes</b>	<b>%</b>	<b>No</b>	<b>%</b>
1. Changing their major	1046	27.9	2705	72.1
2. Changing the university or taking the entrance examination again (changing the major)	990	26.4	2761	73.6
3. Changing the university or taking the entrance examination again ( with the same major)	1141	30.4	2610	69.6
4. Double majors	1338	35.7	2413	64.3
5. Taking another complement subject	1891	50.4	1860	49.6
6. Doing the certain topic research	2183	58.2	1568	41.8
7. Taking teacher training courses	1480	39.5	2270	60.5
8. Taking the course from different department	1746	46.6	2004	53.4
9. Preparing the certification examinations or national examinations	2700	72.0	1051	28.0
10.Prepaing to study abroad	1455	38.8	2296	61.2
11.Prepaing for examinations and further study in Taiwan	2480	66.1	1271	33.9
12. Participate in overseas study program ( such as student exchanged	1439	38.4	2311	61.6
13.Early Graduation	958	25.5	2793	74.5

**(9) What kind of experience do they expect to gain other than academic knowledge**

As to the kind of experience the female freshmen expect to gain other than academic knowledge, their priorities are: making many friends and gaining internship experience in industry. The least score of experience is sex, see Table 15. It is obvious that these female students are focusing on building up the connection and hope to have the practical experience in order to help the employment opportunities in the future.

Table 15: Other experiences expected to gain other than academic experience

<b>Items</b>	<b>Number</b>	<b>%</b>	<b>Orders</b>
To make many friends	3348	20.1	1
Internship in the industry	2429	14.6	2
Travelling aboard	2082	12.5	3
Travelling all over Taiwan to know Taiwan better	2003	12.1	4
Fall in love	1722	10.4	5
Reading all classics	1033	6.2	6

Leading big-scale activities	1322	8.0	7
Be leaders in student clubs	1272	7.7	8
Presenting papers in conferences	697	4.2	9
Participating the university team and representing the university	520	3.1	10
Sex experience	134	0.8	11
Others	59	0.4	12

## V. Conclusion

### **The reasons for women who choose science and technology**

Based on the above finding about the university experience of female students in the field of science and technology, it shows that for these women, the major factors which affect them to choose the university are the subject choice and employment prospects. The reputation of universities and advices from parents and teachers are less important. In terms of their subject choices, personal interest, their academic ability of subject, job opportunity, the potential of career prospect are important factors. In terms of their choices of courses, the personal interest is the major factor and the next important factors are the reputation of teachers and course timetables. The factor of male classmate is the least important one.

When asked about their plan while in the university: gaining more certificates and qualifications, preparing the civil servant examinations and preparing for the entrance examinations of graduate schools are considered as very important. It is obvious that the employment opportunity and studying further are their current major concern.

Overall, it shows that for these female freshmen, career prospect plays a key role in their choices of universities and subject majors. It is shows that not only men, but also women in Taiwan concern about the career prospects while they make decision about their majors. Although it is another issue whether they concern about higher earning as much as men do. Kelly & Cobb

(1991), in their research of 107 gifted adolescents, found that female students indicated career preferences for occupations paying far less money than those which men aspired. Chevalier (2002) also showed a similar finding in the North America that the choice of a university major for men is usually affected by the returns to this subject. Hence, more men tend to be found in subjects that offer higher earnings. In this study, even though these female students in Taiwan all show a great concern for their career development, it is worthy to find out to what extent do they care about financial rewards.

### **Women in science and technology: their areas of interests, values and goals in life**

When asked about their area of interests, interpersonal relationship is what interests these female students most. It follows with writing, drawing, performance or playing the musical instruments. There is very low preference for operating machinery, electrical and carpentering tools, and repairing electrical appliances, furniture and fixing water and electrical problems.

Interestingly, most female respondents also believe that they are better at interpersonal relationship (communication and co-operation) among other things. What they perceive as in need of improvement are: English reading, listening and speaking. Most women think that they should improve their English proficiency. This has also shown that there is a general recognition about the importance of English.

When asked about their goals in life, most of them put having a happy family as their most important goal. It follows with having a good spiritual life and high foreign languages proficiency. Putting 'having a happy family' as the most important goal is indeed a significant finding. For sure, this may affect their action and decision in the future although it would be interesting to find out whether they have changed their priority in life after a few years in the university. The third goal reflect these female students' perception that their foreign language learning are in

need of improvement.

As to what kinds of experiences they expect to gain other than academic work, most women see developing good interpersonal relationship is most important for them. Meanwhile, they also hope to gain practical experience of employment to help the future career.

### **Some concluding thoughts**

This research is significant in the way that it shows that women, even in the fields of science and technology, place great importance on interpersonal relationship. This finding is similar to Lightbody's finding (1995) in Scotland in the mid-1990s as mentioned earlier. Even though they place great importance on career development or advanced study, these female freshmen's major goal in life is 'having a good family.' Whether this kind of goals would jeopardise their career advancement is worthy of further investigation. Most important of all, whether have they been pressured to fill gender roles as Blickenstaff (2005) has suggested also need further exploration.

Moreover, as they place high value on interpersonal relationship, it is also necessary to examine the organisational climate in science and technology industry. It can be assume that if the culture fails to meet the requirement of these women, they may choose to leave the fields in these fields. It is common known that most jobs in science and technology do not require as much interaction with people as jobs in other industry. Thus, the work culture for science and technology is a key issue worthy to be explored further. The Athena Project in the UK is a good example about what can the government do to provide better support for women in science and technology fields. Hopkins (1999) in the USA has reported an impressive victory about the improvement of women faculty's working condition in MIT during the late 1990s. By raising awareness and taking initiatives as such in our higher education institutions, both female students and academics can

be benefited as a result.

Based on the above findings, the authors also suggest to investigate the issue further by conducting qualitative study about female students in the fields of science and technology. By understanding the problems which these female students in Taiwan face and what kinds of support can be offered. Even the statistics worldwide seems to suggest similar situations for female university students in science and technology fields, it would be a mistake to undermine the importance of cultural factors in different societies. Thus, it is necessary to be more critical towards the different factors which affect women's experience in different societies.

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