Interest in ICT Studies and Careers: Perspectives of Secondary School Female Students from Low Socioeconomic Backgrounds

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Abstract

The under-representation of females in information and communication technology (ICT) fields of study and careers continues to attract considerable attention. This article discusses findings of a research study that investigated interest in ICT studies and careers among female secondary school students. The investigation focused on girls from schools in the Western suburbs of Melbourne, Australia, home to families with low socio-economic status and students exposed to "educational disadvantage." The article outlines the demographic background of the participating girls, their experiences with ICT, self-efficacy of ICT skills, and their preferences for future studies and careers in ICT. It also analyzes factors that might have influenced the girls' attitudes towards ICT studies and careers, including their ethnic background, exposure to ICT at school and home, and perceptions of ICT. The article concludes with suggestions for future research.

Keywords: Computing self-efficacy, cultural differences, educational disadvantage, ethnic background, female secondary school students, ICT study and career.

Introduction

A 2006 government report on Building Australian ICT Skills recommended a number of areas to be addressed by government, industry, and education and training providers. One of the recommendations was a call for research on ICT skills in schools so as to identify the factors that contribute to deterring students from considering ICT as an option for further study at university or technical college and as a career choice (DCITA, 2006). In Australia, females continue to be largely under-represented in ICT courses (10% to 30%) and ICT-based careers (under 20%), and the low participation rates have not improved in the past decade (Miliszewska, 2006; PartICipaTion Summit, 2005). Research suggests that ethnicity, race, and socio-economic status are related to low participation and attainment rates in ICT and, when gender and one of more of these factors are combined, there tends to be a cumulative effect (Blackmore, Hardcastle, Bamblett, & Owens, 2003).

In response to the above issues, a research investigation was launched to examine the perceptions of female students from secondary schools in the Western Metropolitan Region of Melbourne towards ICT, ICT studies, and careers; students in this region have been identified as suffering from "entrenched educational disadvantage" (Teese, 2006). The research aimed to:

- Examine attitudes and perceptions of the participating girls towards ICT careers and the skills perceived to be necessary to succeed in such careers;

- Investigate attitude differences related to ethnic background, year level, participation in ICT subjects, and coeducational versus all-girls schools with respect to computer usage and computer careers; and,

- Identify factors that influence female students' attitudes towards ICT and ICT careers.

It is now generally acknowledged by the government, business, employers, and the education and training sectors that there is an urgent need for improved targeting of information and advice on ICT studies and careers to students including secondary school students, with a particular goal to capturing girls' interest. To develop effective strategies to improve the advice, research is needed to first identify and debate key issues including female students' perception about the nature and scope of ICT work and occupations; the findings of this research may inform this identification and debate.

Literature Review

Low participation of women among the designers and creators of information technology has serious consequences, not only for women who are "missing the educational and economic opportunities that are falling into the laps of computer-savvy young men" (Margolis & Fisher, 2002, p. 2), but also for a society increasingly influenced by technology. In the literature pertaining to women's under-representation in the ICT sector, a number of possible factors, such as geography, economy, cultural factors, race, and ethnicity, have been identified as having influence on girls' ICT career decisions (Trauth, 2006). In general, girls tend to report lower levels of interest in computers and lower levels of confidence in their abilities (Grass-Valazquez, Joyce, & Derby, 2009; Hargittai & Shafer, 2006; Volman & van Eck, 2001; Volman, van Eck, Heemskerk, & Kuiper, 2005). Some authors suggested that girls perceive ICT careers as boring, very technical, "nerdy,, and "geeky" (Babin, Grant, & Sawal, 2008; Courtney, Timms, & Anderson, 2006; Margolis & Fisher, 2002). Others reported that females' choice of ICT courses or careers may be influenced by their intrinsic interest in computing as a field of study (Courtney et al., 2006), early exposure to computers, gender stereotypes (Adya & Kaiser, 2005; Trauth, 2002; Volman & van Eck, 2001; von Hellens & Nielsen, 2005; von Hellens, Nielsen, & Trauth, 2001), early exposure to advanced computing subjects (Craig, Fisher, & Lang, 2007), and girls' abilities in mathematics and science (Margolis & Fisher, 2002; Volman & van Eck, 2001).

Girls are not well represented in science and technology courses in secondary schools and tertiary studies around the world, with African girls having the lowest enrolment rates in the world (Derbyshire, 2003; Eidelman & Hazzan, 2006). Goode, Estrella, and Margolis (2006) and Moore (1994) found that students' attitudes and attraction to the ICT field of study were related to their experiences in ICT classes. Girls were found to perform much better in science and technology courses (Bosire, Mondoh, & Barmao, 2008) or to have more positive attitudes toward ICT (Scott, 1996), if they were in single-sex classes or schools, rather than mixed-sex settings. According to Derbyshire (2003), who discussed the use of computers in education in Africa, the aspect of gender becomes particularly illuminated in classrooms where only a small number of computers are available to a large group of students. As Ratsatsi (2002, p. 47) pointed out "gender becomes an issue as the girl child and the boy child would behave differently when it comes to who sits in the driving seat at the computer…boys have the habit of running to the lab to take charge."

The choice of career is an important process in young people's life - a process that is often guided by a complex interplay of pressures, influences, and perceptions (IFACProject, 2008). Factors such as family background, parenting style, parental education and occupation, and socio-economic status have been found to affect young girls' occupational aspirations and career

choices (Adya & Kaiser, 2005; Babin et al., 2008; Gates, 2002; von Hellens et al., 2001). For example, Babin et al. (2008) reported that twice as many female students (34%) than male students (17%) indicated that parents had influenced their career choices. In addition, girls' career choices have been found to be strongly influenced by their fathers (Gates, 2002; Trauth, 2002), as well as working and educated mothers (Smith, 2000). In a recent study by European Schoolnet (Grass-Valazquez et al., 2009), conducted in Italy, Poland, United Kingdom, Netherlands and France, female role models were also found to exert strong influence on girls' decisions regarding further study and careers. Interestingly, in Poland female students were most interested in ICT careers, compared to the other countries in the study, despite their parents' low level of knowledge in the ICT field. It is worth noting that, in this study, the majority of girls in all the evaluated countries enjoyed ICT studies and were competent users of computers and, yet, their interest did not translate into a potential interest in ICT careers.

Traditionally, young girls choose careers in "health, wellbeing, care, applied arts, such as clothing, graphic design … contrary to young boys who select sectors that are related to mechanical engineering, electrical engineering, computers, and finance…" (IFACProject, 2008, p. 10). These views were confirmed by Symonds (2007), who examined students' patterns of future career choices in an English Midlands' city. In this study, male students were more likely to choose careers in engineering, followed by ICT, whereas female students' career interests were in education and health. Symonds (2007) pointed out that, although the two careers were popular choices for all girls, they were particularly common for female students from low SES. Further, this study revealed that the range of career choices became more limited with lower level of student achievement and socio-economic status. According to Klein (2007):

> In an inequitable environment, students will make career choices based on limited factors, including family and personal demographic characteristics. Parent education and occupation, social class, and such factors as acculturation and discrimination all affect how students develop their career expectations. (p. 430)

Methodology

A survey instrument was developed to facilitate data collection from participating students. The survey included both structured (or closed) questions with pre-determined responses and several open-ended questions to give respondents the opportunity to elaborate on their views and motives. This was intended to allow researchers in this study to capture and study nuances of perceptions and attitudes that tend to go undetected in multiple-choice questions.

Participants

This study involved female students from seven government secondary schools: five from the urban Western suburbs of Melbourne, and two from outer Melbourne (the outer region). Of the 1,200 questionnaires that were distributed to students in this study, 464 were returned (a return rate of 39%).

Survey

Questions in the survey were grouped in four sections. The first section aimed to determine students' demographic characteristics and provide information regarding students' family circumstances. The students were also asked if they had a computer and access to the Internet at home, and how much time they spent using those. In the next section questions pertaining to the students' ICT interests and skills were asked. The participants were required to indicate what kind of career they would like to pursue after finishing school and, more specifically, whether they would be interested in an ICT career, what kind of computing experience and level of skills they had,

and whether they found computing interesting. Suggested choice of career options provided to students included: Architecture and Building, Agriculture and Environment, Creative Arts, Education, Engineering and Technologies, Health, Hospitality and Personal Services, Information Technology or ICT, Management and Commerce, Natural and Physical Sciences, and Society and Culture. Students were invited to select as many of these career options as they wished. To obtain information on other potential career interests, an open-ended question was also included in the survey. In addition to nominating future career choices, students were also asked to rate their ability to use computers. The next part of the survey aimed to determine students' perceptions and attitudes with respect to computer use in a classroom; for example, questions were asked to draw out if girls enjoyed classes in which computers were used and whether they found computers useful in their learning. Finally, the last section was designed to seek information regarding the participants' perceptions of gender differences with respect to computer use and interests.

Data Analysis

Chi-square (χ^2) tests were applied to determine if relationships between various student characteristic (categorical variables) were significant. The characteristics analyzed included student demographics, family characteristics, and school characteristics. In addition, a logistic regression model was developed to relate the outcome (response) variable, *ICT as potential career,* to a number of prospective factors (explanatory variables), that is, to determine how each of the factors affected the probability that a student would select ICT as a potential career. Logistic regression was used with a binary response variable which was coded 1 (occurrence of event) or 0 (absence of event) (Venables & Ripley, 2002). In the current context, occurrence of the event for a particular student was "selecting ICT," while absence of the event represented "not selecting ICT." The model fitted to the student data was illustrated by effect displays (Fox, 2003), so that the effect of each factor could be easily interpreted. Statistical analyses were performed using the statistical computing environment *R* (*R* Development Core Team, 2008).

Findings

Participant Profile

The respondents represented all year levels, with a nearly equal representation of 20% from each of Years 7, 10, 11, and 12. Participants from Years 8 and 9 together represented the remaining 20%; however, there were no Year 9 participants from regional schools. Table 1 presents a summary of information about student profile

Table 1: Student profile

Characteristic	N (%)
Year level	
7	94 (20)
8	60 (14)
9	30 (7)
10	87 (19)
11	94 (20)
12	94 (20)
School type	
Co-educational	351 (76)
Girls only	113 (24)
Place of birth	
Australia	361 (78)
Other	103 (22)
School location	
Urban	308 (67)
Regional	156 (33)

As illustrated in Table 1 above, 22% of the participants were born overseas (in 34 different countries). Table 2 shows the ethnic background of the participants grouped by broad geographical regions; ethnic background was determined by the parents' place of birth.

Table 2: Ethnic background grouped by geographical region

Ethnic background	N (%)
Australia and New Zealand	255 (55)
Africa	26 (5)
Asia	107 (23)
Europe	31 (7)
Pacific	36 (8)
Middle East	9 (2)

Nearly 21% of all respondents indicated that they spoke only a language other than English at home. However, as illustrated in Table 3, the percentage varied for students of different ethnic backgrounds. For example, 83% of students of African background and born overseas did not speak English at home; whereas the corresponding percentages for those of Asian and Pacific background were 61% and 67% respectively, and 44% for students of European background.

Table 3: Language spoken at home by ethnic background and place of birth

Ethnic back-ground	Language spoken at home	Place of birth	
		Overseas N (%)	Australia or NZ N(%)
Australia and New Zealand	No English	0 (0)	0 (0)
	English	8 (89)	237 (97)
	English and other	1 (11)	8 (3)
Africa	No English	20 (83)	0 (0)
	English	1 (4)	1 (50)
	English and other	3 (13)	1 (50)
Asia	No English	28 (61)	18 (29)
	English	1 (2)	4 (7)
	English and other	17 (37)	39 (64)
Europe	No English	4 (44)	10 (43)
	English	0 (0)	8 (35)
	English and other	5 (56)	5 (22)
Middle East	No English	0 (0)	1 (17)
	English	0 (0)	4 (67)
	English and other	3 (100)	1 (16)
Pacific	No English	8 (67)	7 (29)
	English	0 (0)	1 (4)
	English and other	4 (33)	16 (67)

Almost all participants from the two schools outside of Melbourne (referred to in this article as 'regional') only spoke English at home (Table 4), which is not surprising considering their largely Anglo-Saxon background (93% of the cohort), as presented in Table 5.

Table 4: Language spoken at home by school location and type

	School location		School type	
	Urban (%)	Regional (%)	All-girls (%)	Coeducational (%)
No English	30	2	40	14
English	38	95	27	67
English and other	32	3	33	19

Table 5: Ethnic background by school location and type

	School location		School type	
	Urban (%)	Regional (%)	All-girls (%)	Coeducational (%)
Australia & NZ	36	93	22	43
Africa	8	0	20	2
Asia	34	3	41	30
Europe	8	4	3	11
Middle East	3	0	4	2
Pacific	11	0	10	12

Family Background

Two thirds (65%) of the respondents reported living with both parents, 30% lived with mother only, 4% lived with father only, and 1% reported living with other family. While 50% of respondents came from families with both parents in employment, 12% of girls indicated that none of their parents was employed. Nearly half of the girls (45%) came from families where both parents were born overseas.

A summary of family-related demographic information is presented in Table 6.

Table 6: Family-related demographic information

Environmental factor	N (%)	Environmental factor	N (%)
Living at home with		Mother's education	
Both parents	300 (65)	0-6 years	38 (8)
Mother only	140 (30)	7-10 years	105 (23)
Father only	17 (4)	11-12 years	194 (42)
Other family	7 (1)	Post-secondary	97 (21)
		Missing data	30 (6)
Parents employed		Father's education	
Both	218 (50)	0-6 years	30 (6)
Only mother	39 (9)	7-10 years	109 (24)
Only father	128 (29)	11-12 years	169 (36)
None	55 (12)	Post-secondary	97 (21)
		Missing data	59 (13)
Parents born in Australia		Parents use computers	
Both	181 (39)	Mother	291 (63)
Only one	68 (15)	Father	271 (58)
None	212 (45)		
Missing data	3 (1)		

The disaggregation of family-related information according to school location and type revealed differences between girls from urban and regional schools, as well as all-girls versus coeducational schools. As illustrated in Table 7, a much greater percentage of girls from urban schools reported that both their parents were unemployed (17%), as opposed to girls from regional schools (3%), (χ^2(3, *N*=440)=44.59, *p*<0.001). Likewise, a much greater percentage of girls from

all-girls school had both parents unemployed (27%), than girls from coeducational schools (8%), (χ^2 (3, *N*=440)=31.46, *p*<0.001). Regardless of school location and type, girls from African background represented the most disadvantaged cohort in terms of parental unemployment – 33% of them came from families where both parents were unemployed.

The responses also revealed considerable differences with respect to parental origin, that is, parents' place of birth; 65% of girls from urban schools reported that both their parents were born overseas, as opposed to 8% of girls from regional schools (χ^2 (2, *N*=461)=153.96, *p*<0.001). Similarly, the majority of girls from all-girls school had both parents born overseas (81%), while only a third (35%) of girls from coeducational schools reported the same (χ^2 (2, *N*=461)=75.08, *p*<0.001).

Table 7: Family context by school location and type

	School location		School type	
	Urban (%)	Regional (%)	All-girls (%)	Coeducational (%)
Living at home with				
Both parents	60	73	53	69
Mother only	33	25	39	27
Father only	5	1	6	3
Other family	2	1	2	1
Parents employed				
Both	39	69	30	56
Only mother	10	7	11	8
Only father	34	21	32	28
None	17	3	27	8
Parents born in Australia				
Both	24	69	14	47
Only one	11	23	5	18
None	65	8	81	35
Mother's education				
0-6 years	13	1	19	5
7-10 years	24	25	27	23
11-12 years	39	55	33	49
Post-secondary	24	19	21	23
Father's education				
0-6 years	11	0	15	5
7-10 years	25	31	22	28
11-12 years	37	50	35	44
Post-secondary	27	19	28	23
Parents use computers				
Mother	52	83	44	69
Father	53	70	43	64

Table 7 also shows differences in parents' educational background. Parents of girls from urban schools had a greater percentage of parents with lower level of education as compared to girls

from regional schools. For example, 13% of girls from urban schools had mothers with, at most, primary level education, as opposed to 1% of girls from regional schools; (χ^2 (3, *N*=434)=30.44, *p*<0.001). Similarly, 11% of girls from urban schools had fathers with, at most, primary level education, as opposed to 0% of girls from regional schools; (χ^2 (3, *N*=434)=19.20, *p*<0.001). The differences were almost as pronounced for girls from all-girls versus coeducational schools: 19% of mothers and 15% of fathers, as opposed to 5% of mothers and 5% of fathers with only primary education; again, the differences were statistically significant at *p*<0.001. The largest percentage of girls who had both parents with at most primary level of education were of African and Asian backgrounds (12% and 13% respectively).

Girls participating in the study were also asked to provide information about their parents' use of computers. According to their responses, 63% of mothers and 58% of fathers (as presented in Table 6) have used computers. However, as illustrated in Table 7, there were differences in the use of computers between the parents of students from urban and regional schools; 52% of girls from urban schools had mothers who used computers, as opposed to 83% of girls from regional schools (χ^2 (1, *N*=464)=41.41, *p*<0.001). Similarly, 53% of girls from urban schools had fathers who used computers, as opposed to 70% of girls from regional schools (χ^2 (1, *N*=464)=11.14, *p*<0.001).

The use of computers by parents differed also for girls from all-girls school and coeducational schools; 44% of girls in all-girls school had mothers who used computers, as opposed to 69% of girls in coeducational schools (χ^2 (1, *N*=464)=20.76, *p*<0.001); and, 43% of girls from all-girls school had fathers who used computers, as opposed to 64% of girls from coeducational schools (χ^2 (1, *N*=464)=15.62, *p*<0.001).

Computer and Internet Access and Use

Overall, the majority of girls reported having access to a computer (97%) and the Internet (90%) at home. However, 27% of girls of African background did not have a computer at home; this is a noticeable figure considering that the corresponding percentages for girls from the other ethnic groups varied between a mere 1% for girls of Asian background to 3% for girls of Pacific background.

Of those who had a computer at home, 42% reported using it, on average, for 1-5 hours per week; likewise, 35% of respondents reported using the Internet for 1-5 hours per week. Almost 17% of students reported spending more than 20 hours a week on a computer. Table 8 shows the details of weekly usage of computer and the Internet at home.

Table 8: Weekly usage of computer and Internet at home

Hours per Week	Computer N (%)	Internet N (%)
0	13 (3)	27 (6)
1-5	193 (42)	162 (35)
6-10	102 (22)	115 (25)
11-20	76 (16)	61 (13)
21-39	36 (8)	29 (6)
40-79	16 (3)	16 (3)
80 and more	9 (2)	4 (1)
Missing data	19 (4)	50 (11)

Of those who answered the question, the majority of respondents (75%) reported that they started using computers when they were 6-11 years old. However, the starting age varied for students from different ethnic backgrounds. As illustrated in Table 9, the earliest "starters" were students of an Australian & New Zealand background; on the other hand, 32% of students of an African background only started using computers at the age of 12 or older.

Table 9: Age when started using computer by ethnic background

	Less than 5 N (%)	6-11 N (%)	12 and older N (%)	Total N
Australia & NZ	39 (16)	187 (77)	16 (7)	242
Africa	0 (0)	17 (68)	8 (32)	25
Asia	0 (0)	85 (81)	20 (19)	105
Europe	3 (10)	24 (77)	4 (13)	31
Middle East	0 (0)	8 (89)	1 (11)	9
Pacific	1 (3)	28 (80)	6 (17)	35

The participants were asked if they used computers to complete homework, and if so, to indicate what kind of software they used. Almost all girls (95%) indicated that they used a computer for homework; 91% of students used Word, 27% of them used Excel, and 57% used Power Point; students also reported using Publisher (6%) and the Internet (8%). Other software mentioned by the students included MS Access, Photoshop, and FrontPage.

Students also responded to questions about computing skills or topics that they had learned or discussed at school so far. As presented in Table 10, the majority of girls indicated that they had used word-processing (78%) and multimedia presentations (75%). Half of the respondents used Web surfing (54%) and used spreadsheets (50%); 39% of girls learned how to set up web pages, and 38% used email. Interestingly, final-year students reported a much lower level of exposure to the more advanced computing skills such as database skills, programming, and Web data retrieval, than students in the earlier year level.

Table 10: Technology/software use at school by year level

	7 (%)	8 (%)	9 (%)	10 (%)	11 (%)	12 (%)	Total N (%)
Word processing	69	72	80	75	85	88	360 (78)
Multimedia presentations	62	77	70	77	80	83	345 (75)
Web surfing	45	47	47	59	65	55	248 (54)
Spreadsheets	26	60	37	47	63	62	229 (50)
Setting up Web sites	18	45	57	41	47	42	180 (39)
E-mail exchange	23	28	20	47	47	49	176 (38)
Web data retrieval	16	12	13	18	25	16	80 (17)
Programming	11	13	13	22	22	17	78 (17)
Database software	6	13	10	13	25	16	66 (14)

Table 11 presents a breakdown of technology use at school by school location and type. The use of technologies that could be considered useful in a variety of schoolwork tasks, such as word-processing, multimedia presentation, or spreadsheets, was similar across urban and regional, as well as all-girls and coeducational school girls. However, girls from urban schools engaged in computer programming considerably more (20%) than girls from regional schools (12%), ($\chi^2(1$, $N=464)=4.12$, $p<0.05$); the use of database software was also significantly higher for girls from urban schools (17%) than from regional schools (8%), ($\chi^2(1, N=464)=5.98$, $p<0.05$).

Girls from all-girl schools exchanged emails less than girls from coeducation schools, 25% and 43% respectively, ($\chi^2(1, N=464)=5.98$, $p<0.05$). However, girls from coeducational schools were less engaged in setting up websites (36%) than girls from all-girls school (50%), ($\chi^2(1$, $N=464)=7.28$, $p<0.01$). Furthermore, girls from coeducational schools used database software less than girls from all-girls school (11% and 24% respectively), ($\chi^2(1, N=464)=10.42$, $p<0.001$).

Table 11: Technology/software use at school by school location and type

	School location		School type	
	Urban (%)	**Regional (%)**	**All-girls (%)**	**Coeducational (%)**
Word processing	76	83	74	80
Multimedia presentations	74	78	81	74
Web surfing	55	53	48	56
Spreadsheets	47	56	50	50
Setting up Web sites	36	45	50	36
E-mail exchange	36	43	25	43
Web data retrieval	18	17	20	16
Programming .	20	12	22	15
Database software	17	8	24	11

In terms of using computers for entertainment, 95% of girls reported using computer for such purposes. Social networks appeared to be the most popular choices, with 58% of girls reporting using MySpace and 33% Facebook; a further 10% of girls reported using Bebo. As presented in Table 12, the reported use of social networking sites was considerably higher among girls from regional schools than from urban schools; MySpace, 67% versus 54%, ($\chi^2(1, N=461)=7.24$, $p<0.01$); and, Facebook, 41% versus 30%, ($\chi^2(1, N=461)=5.65$, $p<0.05$). Similarly, girls from coeducational schools used MySpace and Facebook noticeably more than their counterparts from all-girls school, and the differences were statistically significant ($\chi^2(1, N=461)=5.61$, $p<0.05$ and $\chi^2(1, N=461)=12.48$, $p<0.001$, respectively).

Computer games were used by 54% of respondents, and chatrooms by 40% of them. While the use of computer games was equally popular among urban and regional students, it was considerably more popular with girls from all-girls school (66%) than coeducational schools (50%), ($\chi^2(1$, $N=461)=7.94$, $p<0.01$). Chatrooms were significantly more popular with the urban users (45%) than regional ones (30%), ($\chi^2(1, N=461)=9.12$, $p<0.01$); and, girls from all-girls school used chatrooms more than girls from coeducational schools (59% versus 34%), ($\chi^2(1, N=461)=20.80$, $p<0.001$).

**Table 12: The use of computer for entertainment by school location and type**

	School location		School type	
	Urban (%)	Regional (%)	All-girls (%)	Coeducational (%)
MySpace	54	67	48	62
Facebook	30	41	19	38
Chatroom	45	30	59	34
Games	53	56	66	50
Forum	12	6	17	8
Skype	10	6	9	8

Perceptions of Computers and Self-efficacy (Including Gender Differences)

The majority of female students in this study felt confident in their ability to use computers; 15% of them rated their skills as excellent; 50% as very good; 31% as good; and only 4% reported poor computer skills. Students' perceptions regarding the usefulness of computers in their learning environment were very positive. All students thought computers helped them find new information; 89% of girls indicated that they enjoyed classes in which computers were used; 89% thought that students should learn about computers at school; 75% would like to use computers more often in school; and, 80% thought computers helped them learn more easily.

In terms of the importance of ICT education, 66% of students felt that it would enhance their knowledge; 59% agreed that ICT education would help them function in modern society; and, 47% believed that it would help them in pursuing their future career. Only 33% of participants felt that ICT would increase their social interests, and 31% thought that it would improve their communication ability.

As illustrated in Figure 1, girls from urban schools displayed a greater appreciation of the general benefits of ICT education than their counterparts from regional schools. Similarly, girls from all-girls school recognized ICT benefits more than girls from coeducational schools (Figure 2). In particular, there was a significant difference with respect to the perceived benefit of ICT in helping to pursue future career ($\chi^2(1, N=461)=34.07, p<0.001$).
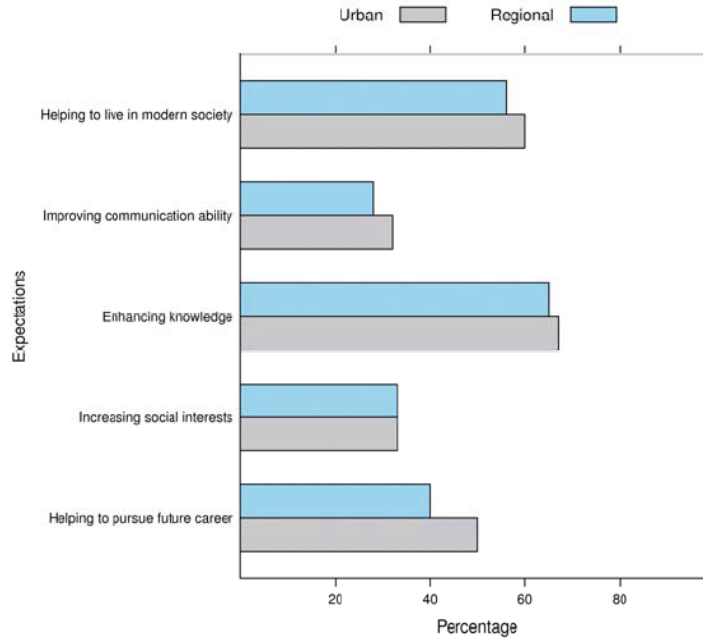
Figure 1: Expectations of ICT education by school location
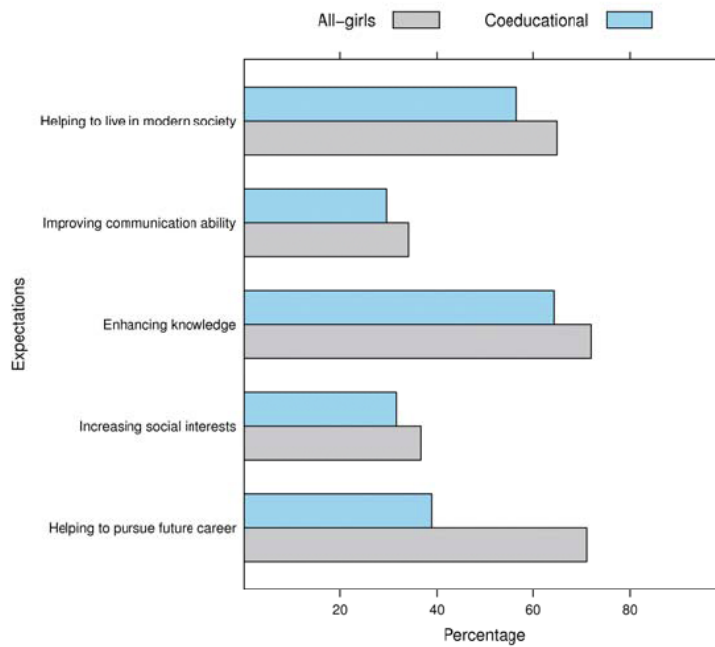
Figure 2: Expectations of ICT education by school type

The majority of girls (82%) were of the view that girls knew how to use computers as well as boys; yet, 52% of them thought that boys were more interested in computers than girls. While the level of assertiveness about girls' computing knowledge, as compared to boys, was the same

among all girls, those from coeducational schools were significantly more likely to believe that boys were more interested in computers than girls ($\chi^2(1$, N=451)= 7.00, p<0.01).

ICT Interest and Career Plans

Overall, girls found computers interesting (50%) or very interesting (31%); 17% were only somewhat interested in computers, and the remaining 2% found computers boring. Of the girls who were either interested or very interested in computers, 75% wanted to develop their computing skills further. On the other hand, only 45% of the girls who found computers either boring or moderately interesting were willing to develop further computer skills.

Respondents were asked to provide reasons for wanting, or not wanting, to develop computer skills further. The reasons for wanting to develop ICT skills did not differ according to year level, ethnic background, or type, or location of the school; the reasons ranged from the pragmatic, through reflective, to future-looking:

> *'To complete homework easier'.*

> *'You need computer skills to get a job.'*

> *'To learn new things'.*

> *'To learn more complicated skills needed for work and everyday life.'*

> *'Yes, because having any knowledge of computers will always come in handy.'*

> *'To improve my computer skills and also to use these skills in my future career; to keep myself up-to-date with IT.'*

> *'They are only going to become more important in society so having a good knowledge of them would be beneficial.'*

> *'To be able to do well in my field and be up to date with 21st century technology.'*

> *'To be able to do more and show others how to and what to do.'*

On the other hand, the justification for not wanting to develop their computing skills any further varied between girls from the different ethnic backgrounds. Girls of European, Middle Eastern, and Australian/NZ backgrounds were least interested in developing further computing skills. While the girls from Australian/NZ backgrounds presented a variety of reasons, there was an interesting distinction between the reasons given by girls from the other ethnic backgrounds. Those of Middle Eastern background did not want to do it because of lack of interest:

> *'No, not really, because I am not really interested.'*

> *'Because I am not very interested in computers.'*

> *'Because I want to do something I really love and computing isn't what I want to do.'*

In contrast, the girls of European background felt that they knew a great deal about ICT already and did not see the need to develop further skills:

> *'Because I know enough to do what I need.'*

> *'Because I already know a lot of things.'*

> *'Because I don't need to. I know as much as I need to know to do what I need to do and that's enough.'*

> *'Because I know enough at the moment to help me with my homework & other interests. And I don't want to pursue a career in ICT & therefore don't think it is very necessary.'*

Nearly one third (29%) of the participating girls stated that they had no interest in an ICT career at all, 37% were 'somewhat interested', 24% were interested, and 10% were very interested. Although overall 34% of girls declared to be either interested or very interested in an ICT career, their choice of future careers did not seem to reflect this claim. The responses presented in Table 13 indicate that the girls opted for careers commonly regarded as "feminine;" their choice of potential career included Creative Arts (30%), Health (28%), Society & Culture (20%) and Education (20%). While 52 girls (11%) also nominated ICT as their career of choice, only 8 of those selected ICT as the only career option. The interest in ICT careers was similar to that in Natural and Physical Sciences and marginally exceeded the interest in engineering disciplines.

Table 13: Future career interest

Career field	One of many selections N (%)	Only selection N
Creative Arts	141 (30)	39
Health	132 (28)	47
Society and Culture	94 (20)	47
Education	94 (20)	30
Hospitality and Personal Services	86 (19)	15
Management and Commerce	61 (13)	16
Natural and Physical Sciences	54 (12)	14
Information Technology or ICT	52 (11)	8
Engineering and Technology	32 (7)	8
Architecture and Building	26 (6)	2
Agriculture and Environment	14 (3)	2

ICT as Potential Career – Statistical Modeling

Binary logistic regression method was used to determine the relationship between the response variable and a number of explanatory variables concerning student environmental factors. The variables in the model were as follows:

- The response variable, *ICT as potential career*, coded as (0) – if a student did not select ICT as one of potential areas of future study, and (1) if a student selected ICT as one of potential areas.

- Explanatory variables included:

  o Student school level (Year 7 – Year 12); school location (Urban, Regional); type of school (All-girls, Coeducational); computer access at home (Yes/No); ethnic background (Australia and New Zealand, Asia, Europe, Pacific); age of first starting using computers (0-5, 6-11, 12 and older); mother's education (0-6, 7-10, 11-12, Post-secondary) and father's education (0-6, 7-10, 11-12, Post-secondary); whether mother uses a computer at home (Yes/No); whether father uses a computer at home

(Yes/No); whether mother helps with computer questions (Yes/No); and whether father helps with computer questions (Yes/No);

o   Number of different software packages/tools used/discussed at school; number of different software used for leisure; hours spent using a computer;

o   Level of interest in computers (boring, only somewhat interesting, interesting, very interesting); self-efficacy (poor, good, very good, excellent); willingness to develop computer skills (Yes/No);

o   Indication of whether girls know how to use computers as well as boys (Yes/No); whether boys are more interested than girls in computers (Yes/No);

A forward stepwise method for variables selection, using Akaike's Information Criterion (AIC), was applied. AIC is a measure computed separately for each model under consideration. AIC chooses models that fit well with a penalty for models that have too many variables (Venables & Ripley, 2002). The "best" model, based on the minimum value of AIC, is selected. Estimated coefficients and their standard errors, as well as t-values from a final model are provided in Table 14. It should be noted that factors "ethnic background" and "mother's education" should be interpreted in terms of the "absent" reference categories, "Australia & New Zealand" and "0-6", respectively.

Table 14: Coefficient for logistic regression model regressing students' potential in ICT career on socio-cultural factors

| Variable	Coefficient Value	Standard Error	Z
Number of software tools used at school	0.36	0.09	3.82****
Coeducational school	-0.70	0.47	-1.50
Year Level	-0.30	0.13	-2.36**
Ethnic background:			
Africa	1.49	0.87	1.71*
Asia	0.82	0.49	1.65*
Europe	0.49	0.72	0.68
Pacific	0.74	0.76	0.97
Mother's education			
7-10	0.94	0.88	1.07
11-12	1.49	0.87	1.72*
Post-secondary	1.16	0.92	1.26
Mother uses computer	-1.07	0.46	-2.31**
Father uses computer	0.73	0.45	1.65*

Significant at: $\alpha=0.001$ (****), $\alpha=0.01$ (***), $\alpha=0.05$ (**), $\alpha=0.1$ (*)

Figure 3 – Figure 8 convey the results of this model in a more clear and informative way, showing fitted relationships between the response variable and significant explanatory variables. The pattern in Figure 3 indicates that the higher the students' exposure to different software tools at school, the higher the likelihood that they will consider ICT as a career option. Figure 4 shows that girls in earlier years of secondary school are more likely to consider ICT as a career option.
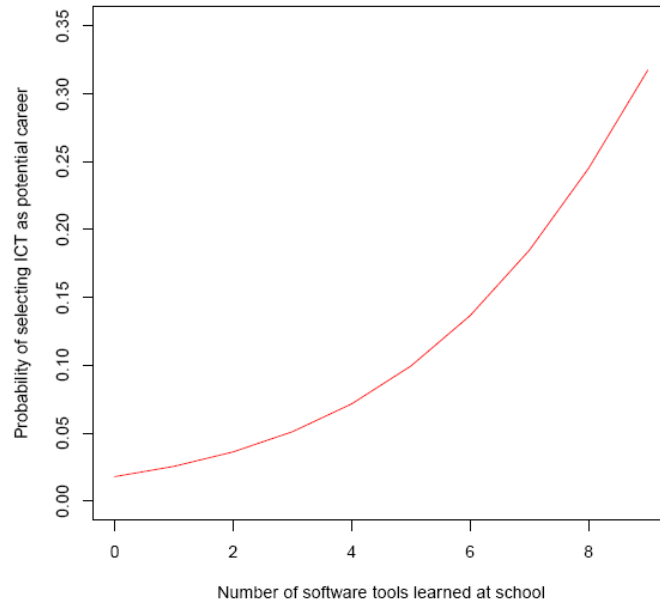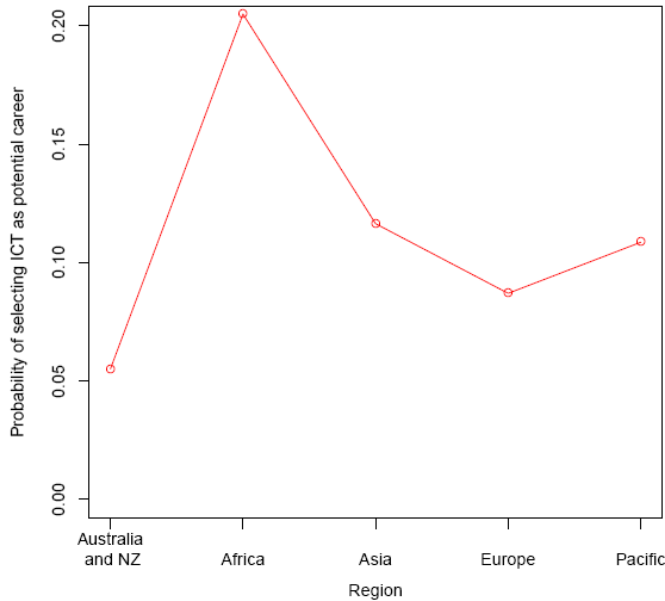
Figure 3: Fitted relationship between exposure to software tools and interest in ICT career
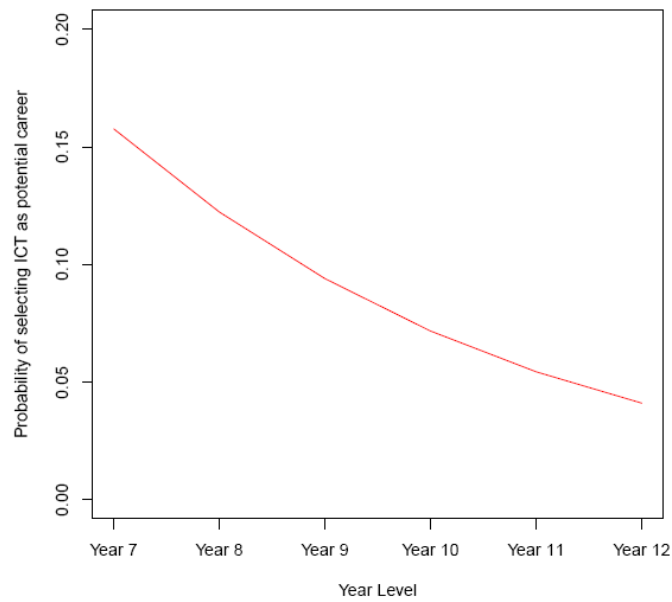
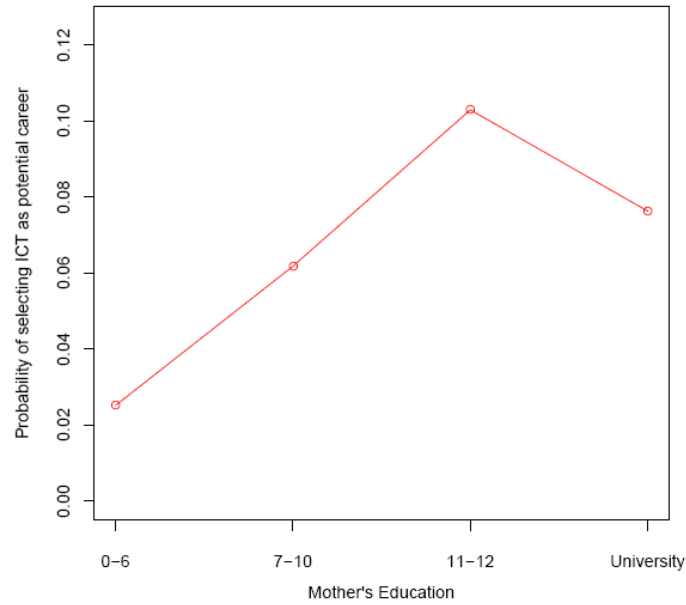**Figure 4: Fitted relationship between year level and interest in ICT career**

The pattern in Figure 5 reveals quite an interesting finding. Girls of an immigrant background were more likely to be interested in an ICT career than those whose both parents were born in Australia or New Zealand. Moreover, students of African background showed the highest interest in an ICT career, followed by students who immigrated from Asia and the Pacific Islands.

Figure 5: Fitted relationship between ethnic background and interest in ICT career

Figure 6 shows that mother's education had a positive influence on students' interest in ICT career, that is, students whose mothers had a higher level of education were more likely to be interested in this kind of career. However, this effect was largest for students whose mothers had 11 or 12 years of education; the effect decreased for students whose mothers had post-secondary education.
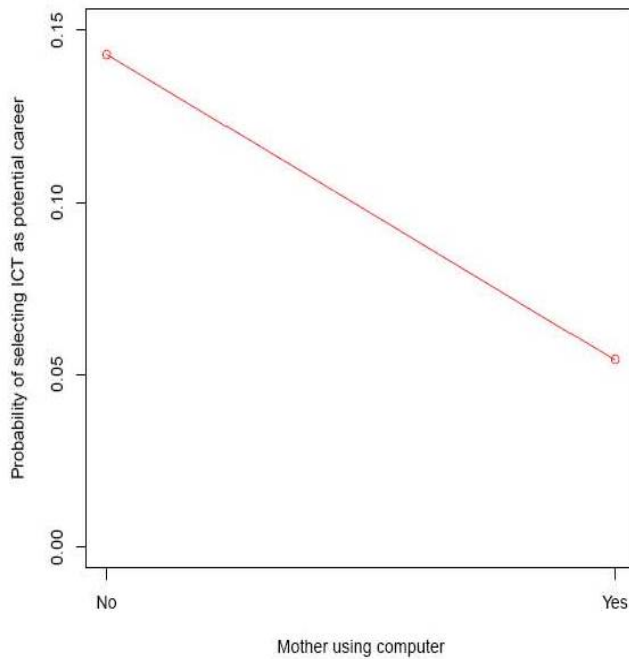
Figure 6: Fitted relationship between mother's level of education and daughter's interest in ICT career

It appears that fathers' use of computers also had a positive effect on the students' interest in an ICT career (Figure 7). Surprisingly, girls whose mothers used computers were less likely to consider ICT as a career option (Figure 8).
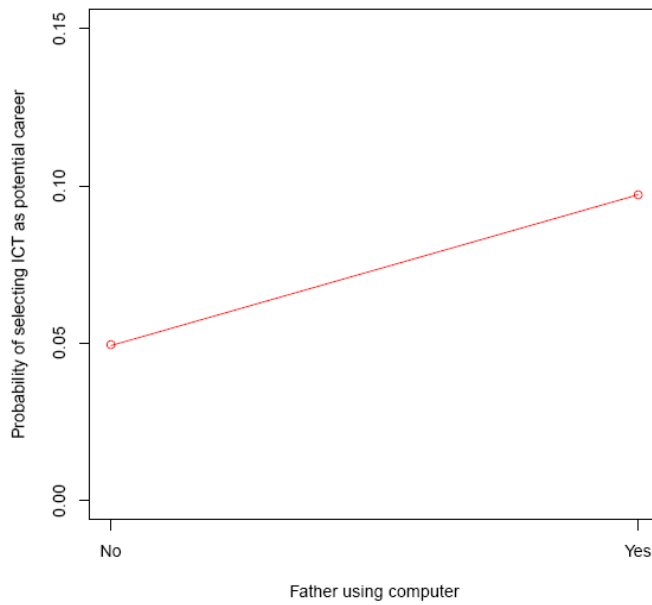
Figure 7: Fitted relationship between father's use of computer and daughter's interest in ICT career

Figure 8: Fitted relationship between mother's use of computers and daughter's interest in ICT career

Discussion

The findings of this study indicate a positive attitude towards computers and ICT among the participating girls; they reported a relatively high level of interest in ICT and rather high levels of self-efficacy in computing skills. These findings seem somewhat "optimistic" in comparison to those reported in the literature (Hargittai & Shafer, 2006; Volman & van Eck, 2001; von Hellens & Nielsen, 2005). Disappointingly, the relatively high levels of interest and self-efficacy did not translate into willingness to embrace ICT as an option for further study or career. ICT merely occupied the eighth place in the ranking of popular career choices and was outnumbered by a career in Creative Arts or Health and a career in Society and Culture or Education. Only a career in engineering or agriculture was considered a less attractive option that ICT. Similar findings were reported in a large European study by Grass-Valazquez et al. (2009), which showed a similar lack of correlation between girls' enjoyment of and confidence in using ICT and their willingness to pursue ICT studies or careers.

Another finding revealed that girls in earlier year levels were more likely to consider an ICT career than their older peers and that exposure to a greater variety of different software tools and services increased students' interest in an ICT career. Final-year students reported a much lower level of exposure to the more advanced computing skills such as database skills, programming, and Web data retrieval than their peers from the earlier year level; a finding supported by the literature (Craig et al., 2007).

Girls of an immigrant background, particularly those of African and Asian roots, expressed a greater interest in an ICT career than those whose both parents were born in Australia or New Zealand. Girls of African background represent a particularly interesting cohort in that their interest in ICT studies and careers was not inhibited by, what could be regarded as, multiple "educational disadvantages." Firstly, these girls had only recently immigrated to Australia from mostly developing countries and had to learn English and adapt to a different society and culture; this could not have been an easy task considering that majority of them did not speak English at home. Secondly, twice as many girls of African background, compared to the others, had both parents unemployed and had both parents with the lowest level of education. Thirdly, a large percentage of girls of African background did not have a computer at home, and they started using computers much later than the rest of the respondents. The positive attitudes and greater interest in ICT might be explained by the fact that the majority of girls of African background attended a single-sex school; this is consistent with the evidence reported in the literature (Bosire et al., 2008; Scott, 1996).

Conclusion

The research study reported in this article investigated the perceptions of ICT skills, studies, and careers among female secondary school students in an educationally disadvantaged metropolitan region of Melbourne, as well as females from regional secondary schools outside of Melbourne. The analysis of the study findings revealed that, overall, female students had positive perceptions of ICT; however, this interest did not translate into consideration of ICT as a career choice. This suggests that there is a large group of female students who might be attracted to ICT studies and careers if provided with adequate encouragement and more information about the opportunities that ICT presents. The results of statistical modelling indicated that, apart from factors such as interest in computers and family background, exposure to different software tools and services, particularly in earlier years of secondary school, played an important role in shaping female students' interest in an ICT career. This indicates that an intense and sustained contact with ICT, beginning in early years of secondary school, may serve as a catalyst for considering ICT as a

future career. An investigation to identify and recommend strategies that would best respond to the issues revealed in this study is currently in progress.

This research expanded on an earlier study (Miliszewska & Sztendur, 2009) and facilitated a stronger verification of the relationships between academic and environmental factors and girls' interest in ICT career. Its findings may help educators, employers, and businesses effectively understand and address female students' attitudes towards ICT and their interest in ICT careers; and, serve as a source of information for educators, employers, and businesses in planning, design, and implementation of targeted strategies aimed at encouraging girls from economically and socially disadvantaged backgrounds to consider a career in ICT.

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