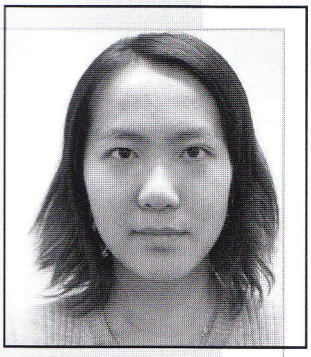
Reasons why female students choose to study senior IT or not

ABSTRACT

Research has shown that girls do not participate as much as boys in Information Technology (IT) in the senior years of high school. Despite research in the 1990s which identified the under-representation of girls in IT, the same pattern still continues. In addition, the complex reasons for this gender divide, and how to counter it, remain unclear. This case study of a single secondary school further informs the growing body of research literature by reporting on the experiences and opinions of female students who did and did not choose to study senior IT. The participant responses were considered as a whole and related to the wider research and policy literature. The findings identify a number of reasons for non-participation including the "geeky" image of IT, lack of confidence, and lack of female role models. Other, more complex reasons are discussed along with suggestions for future research.



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INTRODUCTION

Researchers claim that girls do not participate as much as boys in IT in the Australian education system (Anderson, Lankshear, Timms, & Courtney, 2008; Courtney, Timms, Lankshear, & Anderson, 2005; Lane, 2005; Redmond, 2006a; Timms, Courtney, & Anderson, 2006). Redmond (2006a) finds that girls up to age 11 perceive IT as entertaining and interesting, but start to develop negative perceptions about IT in later years. Research by Timms et al. (2006) has also found that two of the main reasons that girls do not choose IT subjects in their senior years, are that they have 'no interest in the subject' and 'it's boring' (p. 5). In order to further explore the reasons for participation and non-participation, this case study focuses on a Melbourne suburban school and interviews students who did and did not study senior IT.

The participation of female students in senior IT subjects in Australian secondary schools is marked. A 2005 survey supported by the Australian Research Council (ARC) indicated that out of 1453 female respondents in the last two years of high school, 91% were non-takers of IT studies with only 9% of them being takers (Timms et al., 2006). Wajcman (1991) would argue that low level of female participation in IT is due to male dominance which actively excludes women. As a result, girls are less inclined to study a subject which is male-dominated. The exclusion of women from IT related professions was identified by researchers in the 1990s. For instance Wajcman (1991) pointed out that IT professions were male dominated and that schools and the mass media associated IT with masculinity and technological competence. This argument was further emphasised by Sofia (1993) who stated that the under-representation of female IT professionals discouraged girls from studying IT. In addition researchers in the 1990s found that IT was presented as a machine-oriented, mathematical and solitary occupation which attracts 'geeky', 'nerdy' or 'anti-social' technicians (Selby, Young, & Fisher, 1997). Despite extensive research in the 1990s the same exclusionary practices are evident in more recent years (Anderson, Klein, & Lankshear, 2005; García-Crespo, Colomo-Palacios, Gómez-Berbís, & Tovar-Caro, 2009; Graham & Latulipe, 2003; Haisler, 2000; Papastergiou, 2008; Redmond, 2006b). As a result researchers in the 1990s and in recent years have proposed that there is a need to re-address the gendered image of IT and to make it appeal to girls' interests by broadening the focus of learning activities (Braundy, O'Riley, Petrina, Dalley, & Paxton, 2000; Lane, 2005; Redmond, 2006a; Thompson, 2006).

In recent years there have been several successful initiatives and programs implemented to encourage girls to study IT. The 2005 Bracks Government provided the Victorian Women in ICT Network with $82,000 for developing more practical programs to attract and retain women in IT (Davidson, 2005). Similarly, Deakin University in Melbourne held a 2-day 'Go Girl-Go for IT' event in 2006, which attracted more than 2400 girls from Years 9 to 12 (Multimedia Victoria, 2006; Victorian ICT for Women, 2006). The event was aimed at encouraging girls to study and to enter the IT industry. Feedback after the event indicated that 64% of girls would now consider IT as a career, compared to 34% prior to the event (Victorian ICT for Women, 2006). Swinburne University's 'More Bytes: Girls in IT' project also provided girls with problem-solving tasks, and opportunities to use a range of computer applications and multimedia to solve IT problems (Swinburne University, 2005). After the event students reported a renewed understanding of IT, in terms of its usefulness in problem-solving as well as its potential for interactive learning.

In addition to the above initiatives, successful school based strategies have included single-sex IT classes or seminars which were shown to increase girls' interest and confidence in IT studies (Crombie, 1999; Crombie, Abarbanel, & Anderson, 2000; Crombie, Abarbanel, & Trinneer, 2002; Graham & Latulipe, 2003; Lane, 2005; Thompson & Ungerleider, 2004; Valentine, 1998). The research findings also indicated that the participation of girls in IT is also strongly dependent on teachers' preparation and professional development (Timms et al., 2006). In addition to teacher knowledge, schools need to re-address current IT curriculum to re-engage girls in senior IT (Furger, 1998; Jenson, de Castell, & Bryson, 2003;

Lane, 2007; Smith, Pedretti, & Woodrow, 2000). One way to do this is for schools to invite female IT professionals to give presentations at schools, presenting themselves as role models for girls (Lane, 2005; Redmond, 2006b; Silverman & Pritchard, 1993; Zurn, 2005). Valentine (1998) and Zurn (2005) also argue that the media should include more profiles of women in IT. This builds a stronger public image of female professionals working in the field, and promotes IT to girls as a possible and beneficial study and future profession.

The research literature has highlighted girls' under-representation in IT as an on-going issue in secondary education. Findings highlight the need to address the masculine and geeky IT image, to appeal to girls' interests and to include more female role models. While large-scale, primarily survey-based research continues to be conducted, this paper aims to further inform the field through the analysis of a single school case study where the lived-in stories of students and teachers who share a common context are used to triangulate lines of inquiry. Most importantly, the paper aims to enhance existing knowledge regarding females' low participation in IT by interviewing girls in detail to obtain responses about their decisions whether or not to study senior IT. In contrast to many other similar studies based mainly upon author interpretations, this study will analyse data from student participants to identify factors affecting their decisions.

RESEARCH DESIGN

The article is based on a case study conducted at an Australian secondary school. The aim of this study was to examine the reasons which impact on girls' participation and non-participation in IT studies in the final year of high school. The study was undertaken at a co-educational government secondary college in Melbourne. The particular school was chosen for its rich multicultural setting in a middle-class geographical district, and with a low female representation of 22% of the total class number in senior IT classes. Selecting a multicultural school with low female participation in IT was anticipated to yield richer, more varied accounts of female's reasons in senior IT participation and in particular, non-IT participation. An advertisement placed in the school newsletter as well as briefings by senior IT teachers at the school were strategies

Table 1. Comparison of Group A and Group B Responses to Key Interview Questions

Key interview questions	Senior IT participants' responses (Group A)	Senior non-IT participants' responses (Group B)
What were your previous perceptions of IT?	▪ To do with technologies ▪ It is about computers, games, chat and surfing the net ▪ It is about hard drives	▪ Some girls choose IT to 'slack off' ▪ Girls are not well-represented ▪ Computers are for geeks
Why did you choose/not choose IT?	▪ Love being with computers ▪ It is a more relaxing subject ▪ There are more job opportunities	▪ Computers are frustrating ▪ It's not a prerequisite for the course (Media Journalism) ▪ I'm computer illiterate
How do you perceive the IT curriculum at school?	▪ IT teachers are pretty good ▪ Supportive environment ▪ Caters for both boys and girls	▪ More girls are studying IT now ▪ IT is not important ▪ It's always the same thing
How would you describe your competence in IT?	▪ Familiar with everyday technologies ▪ Able to fix computer crashes ▪ Top in the class	▪ Use programs for editing short movies ▪ Use computers for leisurely activities ▪ Use of MSN
Why do think there are much fewer girls than boys studying senior IT?	▪ IT is unappealing to girls ▪ You are a geek if you do IT ▪ IT is something boys do	▪ Limited knowledge of computers ▪ Experience too many computer crashes ▪ Girls are not well-informed
How can IT attract more girls?	▪ Invite more female speakers and role models from IT industry ▪ Inform girls about career opportunities ▪ Seminars for girls	▪ IT should convey more positive images ▪ Include girl-friendly activities ▪ IT curriculum should be taught more differently and interestingly.

used to invite girls to participate in this research. Initially the response was lukewarm yet in the end more than ten participants responded to the advertisement. Due to various constraints of this study, such as the tight timeframe, school's disallowance of interviews being conducted during class time and participants' unwillingness to give up 'free-time', in the end only six female participants were able to participate. This therefore contributes to the limitation of the study due to a small sample size. However, each participant agreed to attend an individual, 20-minute in-depth interview. Both girls who were not studying IT (n=3) and girls who were (n=3) were selected as participants. These two groups were chosen to allow identification and comparison of differences. A semi-structured interview approach was used to allow a freer flow of conversation, where participants could respond to the required topics any time in that conversation. Each participant's responses were analysed in close detail with reference to interview transcripts, recorded interviews and field notes for convergence and divergence across the two participant groups regarding their perceptions of IT in general as well as the influencing factors in their choice to senior IT or not.

RESULTS AND DISCUSSION

The research aimed to identify how possible factors such as stereotyping, curriculum, experiences, perceptions and knowledge about IT studies contribute to girls' participation and non-participation in senior IT. Participants revealed reasons such as being a "computer person" and 'liking computers" for studying IT, in contrast to participants not studying IT who claimed, "I don't need it to study at university" or that they were "computer illiterate". In the following sections, the term "senior year" refers to the final year of high school and "senior IT" refers to IT studies in the final year of high school.

Table 1 on page 31 outlines the two participant groups' (senior IT participants and senior non-IT participants) responses to key interview questions, to allow a comparative analysis of the differences in their decisions to study senior IT or not. Also, for ease of description, senior IT participants' responses are categorised into Group A, and senior non-IT participants' responses are referred to as Group B.

The two groups' responses to each question are discussed below.

Previous perceptions of IT

Group A participants seemed to have limited understanding or exposure to computers prior to studying IT, as they described IT as, "to do with technologies," "it's about computers, games, chat and surfing the net" and another participant claimed, "I didn't even know what a hard drive was." In addition the students reported that when they chose to study IT they had a limited understanding of the subject and associated careers. This lack of knowledge about IT, the subject and related courses and careers prior to studying IT is an interesting finding because it might otherwise be assumed that a lack of knowledge might result in non-participation. Certainly a number of initiatives to increase female participation in IT studies have focussed on increasing student awareness of the subject (for example: (Davidson, 2005; Multimedia Victoria, 2006; Swinburne University, 2005; Victorian ICT for Women, 2006). This case study's findings suggest that further research may need to be conducted to identify the significance of this issue in relation to other influences.

In contrast, Group B participants proclaimed, "There are so few girls in IT... whereas I know about Bill Gates," while another claimed, "Some people just choose it to slack off." This participant further explained that many girls seemed to study IT due to the assumption of it being an easier subject. This suggests that girls may have studied IT simply to deviate from the possibly more difficult, mainstream subjects. Also, the image of IT as "geeky"" from another Group B participant also suggests that most girls have little realisation about what IT offers. On the whole, it appears that participants from Group A initially perceive IT in terms of hardware and software prior to studying in the field, compared to Group B participants who associated IT with personal views, regarding those who study IT as "geeks" and "to slack off". It can also be seen that pre-conceived perceptions of IT play a determining role in girls' subsequent choice or non-choices of senior IT studies. This contrasting insight also suggests the importance of equipping girls with further, more varied information about IT as a study and career option to address possible prejudices toward individuals studying and achieve higher participation of girls in the field.

Choices/non-choices of IT

Reasons for choosing to study senior IT for Group A participants were that "It is an easier and more relaxing subject than Physics or Chemistry," "I love being with my computers" and "There are more job opportunities." However, the participants recognised that their studying of senior IT was unusual and referred to the low number of girls in their IT classes in comparison to the number of males. The under-representation of females in senior IT in this case study reflects a wider trend such as that reported in Queensland, where only 5% of all girls in the final year of high school studied Information Processing Technology (IPT) and Information Technology Systems (ITS) (Courtney, Anderson, Lankshear, & Timms, 2007). In contrast, Group B participants discussed their reasons for not studying senior IT, "It's not a prerequisite for gaining entry into the course [Media Journalism]," "Sometimes I find computers frustrating... like it has a mind of its own... I also can't see it as a career," while the last participant declared, "I'm computer illiterate." Selby et al. (1997) and Papastergiou (2008) suggest that girls' inadequate knowledge of IT and career opportunities might have discouraged them from studying IT. Moreover, Group B participants' previous frustrating experiences may have contributed toward their non-participation in senior IT. Timms et al. (2006) highlight that female students tend to develop negative perceptions toward IT when they frequently experience frustration with computer software or hardware. It is therefore important for IT educators to provide students with an experience free from unnecessary frustration.

Overall, it is evident that Group A participants' positive computer experiences and the acknowledgement of IT related

careers may have subconsciously shaped their decisions to pursue senior IT. Conversely, Group B participants' previous IT experiences and career aspirations lacked the positive emphasis of those of participants in Group A, and consequently they did not participate in senior IT studies. It is therefore vital for further research to be conducted into the reasons for girls' participation or non-IT participation in senior IT, to further strengthen the factors which encourage, and to address factors which discourage participation. This would inform the improvement of curriculum, school resources, teacher support, role-modelling and other strategies to motivate girls to enter the traditionally male dominant IT sector.

Perceptions of school's IT curriculum

While stating the reasons and strategies for boosting female representation in IT, Group A participants' responses nevertheless show a high degree of satisfaction with their school's IT program. Participants commented on the helpfulness and supportiveness of IT teachers, "Our IT teacher is pretty good... he helps people with problems and technical stuff," "They just help when you need help," "The teachers are quite encouraging of both girls and boys." The teacher support as offered to students is in line with Crombie's (1999) and Redmond's (2006a, 2006b) findings that supportive teaching increases girls' IT participation. On the other hand, Group B participants did acknowledge the fact there seems to be "More girls studying IT now", but the other two Group B participants presented more pessimistic views, commenting that "IT doesn't seem that important" and "We do the same thing over and over again each year in IT." It is worth noting that girls in Group A reflected encouraging views such as the supportiveness of teachers and the IT learning environment. In contrast Group B participants appeared to place less value on IT subjects as a study option and also commented on the repetitive nature of tasks in the school IT curriculum perhaps from previous experience. However, Redmond (2006a) suggests that if girls were provided with more skill-building projects involving the use of various technologies, it will increase their interest in IT and also enable them to recognise the importance of being able to effectively utilise these IT skills for future studies and employment.

Competence in IT

Indeed, the school IT curriculum may have deterred some from studying, yet IT participants in Group A point to teacher supportiveness as vital for their confidence in IT competencies, "I'm very familiar with everyday technologies," "Top in our class when it comes to work," while the third participant explained that IT has developed her confidence and potential for independence, "Just say next time if something happens, our computers crash down, we don't always have to look for a guy to help us... we can do it on our own." Participants concluded by stating that studying senior IT has increased their confidence, independence and essential IT skills for future studies and employment. Group B participants however, described their competencies in IT differently, commenting on their abilities to use IT for personal uses, "IT is great for things like using a program for editing short films," "I use computers for leisure" and another simply said, "I love using MSN [messenger]." These activities suggest that Group B participants are using technology at a relatively complex level, from using movie editing programs to using MSN Messenger for online chatting. Since these students are engaging with technology, their comments regarding previous frustrating experiences which influenced their decision not to study senior IT should be considered with caution. Closer examination of the data suggests that when they referred to frustrating experiences they may have been reflecting on formal teaching and learning contexts. Further research should be conducted into the nature of student frustration with IT and its relationship to teaching, school based learning and school technology.

Low female participation in IT and strategies for improvement

Frustrating experiences in IT may have been a factor which contributes to the lack of participation of girls in senior IT yet Group A participants explained that this could be due to stereotyping, "Many girls still view IT as something boys do," "They think that, oh you do IT so you are a geek," whereas one viewed IT as "Something boys do." This supports the contention that a negative image of IT studies is one of the key reasons which contribute to girls' declining participation in senior IT studies (Anderson et al., 2005; García-Crespo et al., 2009; Haisler, 2000; Selby et al., 1997; Silverman & Pritchard, 1993; Timms, Lankshear, Anderson, & Courtney, 2008). In response to this perceived negative image one of the Group A participants in this study stated, "We need more speakers and role models...we need to see more female professionals in IT to help us understand that women can also work in IT industries, not just men." In contrast, Group B participants suggested that the under-representation of girls could be due to lack of knowledge in IT, frustration associated with perceived computer errors but also that girls were ill-informed. Their responses also suggest that they had little knowledge of the subject selections and future professions available in IT. This finding has already been identified by researchers who also recommend that schools invite more guest speakers, provide more career counselling and better inform students about the study and career opportunities in IT (Lane, 2005; Meelissen & Drent, 2008; Silverman & Pritchard, 1993). However, it has already been pointed out that the female students in this research who chose to study IT also had little knowledge of the subject and career opportunities. Although this is a small case study, the conflicting data does suggest that further research needs to be conducted. One Group B participant further expressed one way of improving girls' interest in IT, "If the junior IT curriculum had been taught more interestingly then I would have enrolled in IT." From this, it is evident that the ways that the IT curriculum is delivered can affect girls' participation in IT, which was supported by Crombie (1999). Timms et al. (2006) also claim that teacher preparation and professional development, curriculum and maintenance issues are vital. In addition to the importance of teaching, one participant in Group B also stated, "IT should include more girl-friendly activities, like girls-only IT clubs, where girls can learn and use the latest programs and technologies free from the hassle of boys." Redmond (2006a) too claims that interactive projects can promote girls' interest in IT

and single-sex settings can provide more opportunities for girls to experiment and acquire IT skills.

The findings from the study suggest that there are a range of factors for low female participation in high school IT subjects, which consequently affect their participation in tertiary computer degrees later on. Clearly more research is needed to explore the link between girls' reasons for choosing or not to choosing IT subjects in high schools as having a direct impact on their ultimate decisions of IT degrees at universities. The study as discussed in this paper will act as a pilot study which provides valuable information for informing the current doctoral research, which examines the factors which influence female undergraduates' participation in Computer Science.

CONCLUSION

A range of factors influence girls' choice to participate or not participate in IT studies in their final year of high schooling. The findings of this study suggest that female under-representation in senior IT subjects may be due to female students having:

- limited understanding of IT as a potential study and profession,
- negative perceptions of IT as "geeky,"
- low confidence levels in performing and utilising software and hardware,
- previous frustrating experiences in using IT,
- limited exposure to female role models in IT,
- perceptions of IT as an easier and less academically rewarding subject.

However this study has highlighted the complexity of this field. For example, while some of the students reported that limited understanding of IT as a subject and career was a deterrent, the data also indicated that for the three students who did choose to study IT their limited understanding of the subject and career opportunities did not result in non-selection of the subject. Clearly further testing is required.

Another example is that students who did not study senior IT and had reported being affected by previous frustrating experiences in using technology were nevertheless highly engaged with social and entertainment technologies outside of school. This highlights the need to be more careful when discussing technology and senior IT studies as they are not synonymous.

Participants also illustrated the need to make IT appeal to female students as a subject with an interesting curriculum and an important status in high school. The students who were studying senior IT all agreed that the teacher's support in IT was invaluable. However, it is important to note that although the IT teacher participant implemented strategies to support his female students, a greater variety of projects and tasks need to be provided to cater for the different learning styles of individuals.

Overall, this research presented female students' reasons regarding their participation and non-participation in IT studies in the final year of high school. The scope of the current research was focused on gaining participants' views and perceptions about IT within a local context. This approach appears to have confirmed many of the findings of current research literature, however it has also revealed some conflicting findings which need to be investigated further. As a result, it is suggested that further case study research with a wider sample is necessary to explore more deeply the complexities in the data. The study as presented in this paper is therefore to be used as a preliminary pilot study for the current doctoral research, to further examine whether the factors which caused girls to choose or not to choose IT subjects in high schools occur when they make tertiary course selections in computer degrees, especially Computer Science. It is anticipated that the doctoral research will also adopt Eccles et al. Expectancy Value Model (1983), to furtherexplore the psychological and social factors which influence course enrolment decisions made by females in the field of IT.

BIOGRAPHY

Shu-Hua Chao *is a PhD candidate at Monash University in Australia. Her doctoral research is on female undergraduates' participation and non-participation in Computer Science degrees in Australia and Taiwan. Prior to her PhD candidature Shu-Hua was a research assistant at the Institute of Education, National Cheng Kung University in Taiwan and was involved in several projects researching areas such as high school curriculum standards in countries such as the United States, New Zealand and Australia. Shu-Hua's research interests include female participation in IT study and professions, gender education and the use of software in IT classrooms.*

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