Secondary girls' perceptions of advanced ICT subjects: Are they boring and irrelevant?

ACEC2006 – Best ICT in curriculum and pedagogy and Best overall paper

This paper reports on two questions from a survey of year 11 and 12 girls' perceptions of the two advanced computing subjects available within Education Queensland (EQ). The two subjects are Information Processing Technology (IPT) and Information Technology Systems (ITS). Similar to trends in other western countries, the Queensland experience demonstrates that the number of girls enrolling in IPT and ITS are declining to a level which causes concern. Therefore engaging girls in advanced level computing subjects has become a priority. Girls from 26 government (GS) and non government schools (NGS)(n=1453) participated in a survey which was conducted by members of the research team at James Cook University(JCU) as part of a larger Australian Research Council (ARC) Linkage Grant project. The current paper examines responses to 'The subjects are interesting' and 'I am interested in computers' with particular attention to how attitudes of Non Takers of IPT/ITS diverge from those of Takers. Mann-Whitney U test comparisons found significant difference in attitudes between these groups. These data were reinforced with rich qualitative responses indicating these subjects were generally perceived by girls in high school, as boring, dull and uninteresting.

Information and communication technology (ICT) use is widespread in industralised societies, with computer literacy developing as an important survival skill for those wishing to negotiate even the most basic of transactions such as banking or booking an airline ticket. Therefore, it would appear that those who write software programs and develop the ICT industry that supports our society are in fact cultural architects. Despite the importance of the ICT industry, it would appear that ICT is below the radar of many young people when considering possible future careers, particularly in the case of young women. While women comprise over 50% of users of technology, numbers of women involved in creating the programs that drive technology are continuing to decrease (Frieze, 2005). Currently, most researchers report a female participation rate of 20% in the ICT industry and even fewer women are leaving university as graduates in ICT (Margolis & Fisher, 2003; Millar & Jagger, 2001).

Within Australia this issue has generated concern at government level (e.g., Queensland Government, 2003; State Government of Victoria, 2001). On one hand, concern is aimed at possible implications for the capacity of women to achieve economic confidence in a job market which is becoming increasingly highly skilled (Queensland Government, 2003). On the other hand, the participation of women in the dialogue of computer scientists is an imperative for the design of programs and technology which have the most relevant applications in a complex and increasingly computerised culture. It would appear that the skewed gender ratio of computer scientists, documented in numerous countries (Millar & Jagger, 2001) represents a loss of opportunity for women. An acute concern is thereby generated that ICT firms, which have low numbers of women professionals, are at distinct disadvantage with respect to being able to consider a wide range of perspectives. The highly competitive, male dominated ICT industry operates within an increasingly sophisticated and discerning marketplace (Millar & Jaggar; Trauth, 2002). It is, therefore, essential that greater numbers of girls are recruited to undertake ICT at high school and are thereby guided into degree streams in ICT at university.

Attracting girls to advanced ICT subjects that provide fundamental understandings of the discipline and which contribute to the ability to undertake computing at an advanced level, has proved to be a difficult proposition (Anderson, Klein & Lankshear, 2005). Accordingly, engaging girls in computer subjects has become as important a priority in Queensland (Queensland Government, 2003) as it is elsewhere (Millar & Jagger, 2001). A number of possible deterrents ranging from a predominantly male and thereby inherently alien environment in the classroom to a computer game culture which invalidates the values and interests of girls have been identified in the literature (Millar & Jagger). However, notwithstanding the seminal work of Margolis and Fisher, research in this area has historically suffered from a lack of contextual understanding (Anderson et al.). According to Margolis and Fisher 'girls are rarely

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inspired by computers and when they are, it is only to have the interest extinguished during the school experience'(p. 3). Cohoon (2003) suggested that girls' interest in computers tend to develop later than that of boys and consequently boys enjoy a head start in computer awareness which then becomes assumed knowledge within high school curricula. This explanation would seem to account for widely reported lack of interest reported by girls when provided with the opportunity to choose technical computing subjects (Millar & Jagger).

Lynn, Raphael, Olefsky and Bachen (2003) suggested that female students were 'more likely to use computer applications for word processing, graphic design, and communication instead of tinkering, play, programming, or systems design' (p. 144). However, Lynn and colleagues also asserted that 'when girls are exposed to computers in single-sex settings with supportive teaching and appropriate software, they show increased interest and confidence in the technology' (p. 146). This would suggest that one challenge for education is to provide interesting and supportive experiences for girls within the frameworks of the ICT curriculum and teacher expertise and knowledge. Compounding this issue is a widespread perception among young women that computer subjects are boring and possibly irrelevant. Additionally, there is an equally widespread lack of awareness of the variety of roles and sheer interest value of computer science as a discipline (Victoria State Government, 2001).

Embedded within the challenge is the need for ICT subjects to compete with an increasingly varied number of choices within career streams available in high schools. This point is illustrated in the research of Edelman and Hazzan (2005) who compared take up of ICT in high schools within Israel where two educational sectors run side by side. In the minority Arab educational sector 50% of the students studying ICT were female, while in the more westernized majority Jewish sector the percentage of female participation in ICT was only 25%. Edelman and Hazzan noted that Arab students had less choice of subjects than Jewish students. Consequently, there was not as much competition from subjects like drama, theatre or art, which appear to be more attractive for girls. This would suggest that challenges facing advanced computing subjects include competition with subjects which are superficially more attractive.

This paper reports on one aspect of the survey phase of a much larger Australian Research Council (ARC) Linkage Grant (Anderson et al., 2005) combining Education Queensland, Technology One and the authors' team at JCU as partners. One of the aims of the larger project is to identify priority strategic response items in the interests of enhancing female participation rates in ICT subjects. To this end two of the five research objectives of the larger project are:

- To obtain a rich and extensive Queensland data set for female students at Years 11 and 12, and at the point of entry to university study pertaining to their views and decisions about ICT programs and careers.
- To identify possibilities and priorities for co-operative, informed cross-sector strategic responses to the issue of low rates of female participation in ICT.

METHODOLOGY

Two populations of female students, approximating to 'typicality' by socio-economic status, location, and school type, GS/NGS were identified for survey purposes. The first comprises students taking Board Level ICT subjects (IPT or ITS). These are the 'Takers'. The second group is of 'Non Takers'. Questions for the survey were determined on the basis of findings of a pilot survey conducted in 2004 (Anderson et al., 2005), and further informed by previous research (Margolis & Fisher, 2003; Millar & Jagger, 2001)

Participants

The participants were 764 Year 11 and 674 Year 12 female students attending 26 schools in Queensland. Sixteen respondents did not indicate their year resulting in a total of 1453 respondents. A total of 1322 respondents (91%) were 'Non Takers' and 131 respondents (9%) were 'Takers'. A more complete breakdown of the respondent detail appears in Table 1. The survey was voluntary and responses were only accepted from participants who completed consent forms in accordance with ethical clearance requirements. In some schools response rates approached 70%, while in others the response rate was below 10%.

Table 1.

Breakdown of participant details.

	Takers of IPT/ITS (or both)	*%*	*Non takers of IPT/ITS*	*%*	**Total**
Year 11	81	5.6	677	46.6	758
Year 12	47	3.2	632	43.5	679
Year unknown	3	.2	13	.9	16
Totals	***131***	***9***	***1322***	***91***	***1453***

Materials

The pen and paper survey consisted of a mixture of Yes/No questions, Strongly Disagree to Strongly Agree questions on a 5-point Likert scale and open questions.

Procedure

The pen and paper survey was conducted between August and November 2005 with Years 11 and 12 female students throughout Queensland. Twenty-six, of the 31 schools invited, elected to participate. School selection was based on an attempt to obtain a study population as typical as possible of the state as a whole, but without any claims to producing a representative sample. Emphasis was on pursuing scale of responses and ensuring that participants ranged over key variables like socio-economic status, ethnicity, rural/urban location, school systems (GS/NGS). Schools were supplied with sufficient questionnaires and complete instructions. Most surveys were completed at school, however, in some instances surveys were sent home.

Completed surveys were returned by the schools and entered into SPSS by means of scanning software. Statistical comparison of responses of Takers with those of Non Takers required some manipulation of the data set. In line with previous experience in the pilot study, questions for Takers had been framed positively (e.g. 'The subjects are interesting') and those for Non Takers had been framed negatively (e.g. 'The subjects are boring'). This meant that a statistical comparison of the two groups was only possible after scores for Non Takers had been reversed on those questions which demonstrated polarity with those of the Takers. For the present paper focus is on two question sets, (see Table 2).

Table 2.

Question sets which were reverse scored for statistical comparison between Takers and Non Takers.	
Takers	**Non Takers (reverse scored)**
The subjects are interesting.	The subjects are boring.
I am very interested in computers.	I am not interested in computers.

RESULTS

Mann-Whitney U test comparisons found significant difference in attitudes between Takers and Non Takers in both variables examined in this study (see Table 3). The comparisons are plotted in Figure 1.

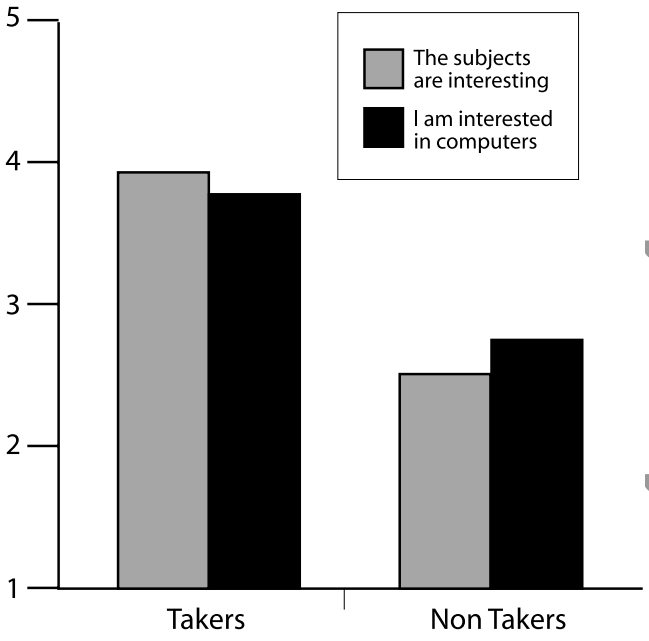

Figure 1.
Comparison of Takers' and Non Takers' responses to 'the subjects are interesting' and 'I am interested in computers' (1= Strongly Disagree, 2= Disagree, 3 = Neither Agree or Disagree, 4 = Agree and 5 = Strongly Agree).

Qualitative data responses of Non Takers were discussed at length by the research team and sorted into 12 categories with the bulk of responses falling into 'no interest in the subject/boring'. More detail on these categories can be examined in Table 4.

Table 4

Participant comments to question asking why they chose not to do IPT or ITS.

	Non Takers (n = 1322)		
	Theme	*n*	*%*
1	No interest in subject - boring	268	20.27
2	Subject is too hard and I'm not smart enough	46	3.47
3	Does not suit my career path	109	8.25
4	Didn't suit my timetable	39	2.95
5	I just chose not to	71	5.37
6	I chose other subjects	102	7.72
7	I did not know it was a subject	24	1.82
8	Limited computer skills	29	2.19
9	Previous experience put me off	13	.98

Note. Many respondents did not provide comments.

Table 3

Mann-Whitney U test comparisons of relationships between Takers and Non Takers and study variables.

	Takers			Non Takers				
	N	Mean	SD	N	Mean	SD	U value	Significance
The subjects are interesting.	130	3.89	.99	1314	2.60	1.26	37402.00	.000***
I am very interested	130	3.76	1.03	1314	2.85	1.31	51609.00	.000***

*** $p < .001$

DISCUSSION

An objective of the current research was to obtain a rich and extensive Queensland data set for female students at Years 11 and 12 and provide information on their perceptions of ICT and decisions about ICT programs and careers. There was little doubt as to the views of Non Takers in this particular study. Significant Mann-Whitney U test comparison at the < .001 level confirmed a trend to polarization between Takers and Non Takers on 'the subjects are interesting' and 'I am interested in computers'. While this response was expected in light of previous research (Anderson et al., 2005; Millar & Jagger, 2001), it served to consolidate these findings in a quantitative form. In addition, qualitative responses from Non Takers provided rich insight into dimensions of girls' perceptions of the ICT courses available in Queensland. Investigation of the 268 responses of Non Takers who indicated lack of interest in computers and computing provided a sense of the wide ranging views of these girls.

Open questions in the survey provided some insight into girls' perception of advanced level ICT subjects as boring. Many responses referred to the mechanical nature of computers as opposed to spending time with or working with people. For example:

Computers just don't interest me. I'd rather spend time with a person rather than a machine and I am ignorant in computers (Year 11 student, GS).

The observation that girls tend to be repelled by perceived lack of social interaction when using computers was a recurring theme in Adya and Kaiser's (2005) review of the literature. Furthermore, Adya and Kaiser indicated that women who did pursue computing as a career tended to be more solitary in nature, it therefore follows that this perception would transfer over to contemplation of the computer industry as a possible future career.

While a majority of students reported that computer subjects were boring, they provided little information to researchers about why the subjects were perceived as boring (e.g., were computers boring? Were the subjects boring? Were the teachers/teaching methods boring?). Some students provided glimmers of insight. For example,

It's boring in high school. I find computers incredibly interesting and would love to have studied ICT in high school and continued that study through to university if it was more interesting. I had limited experience and it seemed difficult (Year 12 student, NGS).

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This participant's comment supports Cohoon's (2003) suggestion that while girls may be interested in computers, they are often 'put off' by their perception that they do not have enough prerequisite knowledge to undertake the challenge posed by advanced computing classes. This would appear to be a two fold problem of student perception and preparedness of education systems to accommodate the needs of such students. Adya and Kaiser (2005) commented, 'K-12 systems need to provide an environment where teachers can become comfortable with their technology preparedness and convey enthusiasm about it to students' (p. 252). They also cited a need for teachers to provide an atmosphere of equity and engaging interaction within computing subjects. The need for supportive teaching was also mentioned by Lynn and colleagues (2003) in the interest of developing confidence, this aspect was alluded to by Non Takers, albeit in a negative form.

In junior the teacher made me dislike it and there wasn't much 'fun' involved (Year 11 student, GS).

I studied ICT in my junior years of high school, and strongly regret it, as I found I hated this subject (Year 11 student, GS).

Another factor, may be 'bad press' from those whose job it is to provide career advice to students:

Certain Counsellors [sic] made it seem dull (Year 11 student, GS).

In addition, Adya and Kaiser emphasized the importance of providing students with an experience free from unnecessary frustration. This is consistent with student responses from the current study:

Computers are crap and they are boring and I don't like working on school computers cause they are crap and never work properly (Year 11 student, GS).

Hence, teacher preparation and professional development, curriculum issues and maintenance issues are all vital ingredients in planning for change in order to reverse current trends. Supportive teaching, therefore, requires social as well as computer fluency, and awareness on the part of educators of how important it is to attract diversity to the ICT industry.

Nevertheless, the problem of attracting girls to advanced computing subjects is not solely an education problem. Trauth (2002) highlighted the socio-cultural milieu with attendant messages which have some bearing on the choices of girls and ultimately affect their future alternatives. Frieze (2005) suggested that the industry as a whole suffers from serious misperceptions that 'that the field is populated by geeky guys' (p.397) and that 'the field itself is seen as little more than coding' (p. 397). Missing from the picture is an image of computer science as a dynamic and interesting field with abundant opportunities for a creative and challenging future. This aspect was apparent in student responses:

> *I don't like ICT and computers. Don't need ICT in the future (Year 11 student, GS).*

> *I would rather interact with people than a computer (Year 12 student, NGS).*

One important reflection from Edelman and Hazzan's (2005) study was the possibility that numbers choosing advanced computing was negatively affected by extensive subject choice. This observation resonates with responses of many participants in the current study who indicated that the array of subjects available offered many more interesting alternatives than the study of advanced computing:

> *Because I had other subjects that I would like to concentrate on and I wasn't particularly interested in the subject because I did it in year 10 (Year 12 student, GS).*

> *I wanted to take other subjects which are more interesting to me (Year 11 student, GS).*

This would suggest that any examination of the reasons why girls choose not to do ICT should also examine what is offered them by the subjects they do choose to do and why they prefer these to advanced ICT subjects. This should then provide educators with the necessary information to provide subjects that engage students more effectively and prepare them more thoroughly for the digital world they will inhabit in the future. Frieze (2005) suggested 'we may find that some of those aspects of the field that have been deterring women from entering are actually deterring all students, and strategies for change may well result in increasing enrolment overall and a more gender balanced environment' (p. 397).

The current paper reports on research which has confirmed and elucidated further, the complexity of the problem on declining numbers of girls participating in ICT subjects in high schools. However so far it has not been able to provide the research team with more than a glimpse of the processes which are taking place in the minds of girls. It is anticipated the research reported on in this paper, will contribute to this knowledge by informing the development and nature of focus group sessions which are the next phase of the much larger research project. The focus groups are expected to add a deeper understanding of what 'boring' means to these girls, and to shed light on the polarized views of the subjects held by the Takers and Non Takers concerning advanced ICT subjects. If the subjects are boring and irrelevant, curriculum reform may be urgently needed. On the other hand, if the negative perception held by the majority is based on a misconception, perhaps attractive subject labelling, marketing and awareness-raising could be effective strategies.

BIOGRAPHY

CAROLYN TIMMS *has had a long career as a high school teacher. During the last few years of teaching she studied Psychology by distance education and entered Honours in Psychology at James Cook University in 2004. In 2005 (her first year of PhD candidacy) she was employed part time as a Research Officer in the School of Education, assisting Associate Professor Neil Anderson with the Girls and ICT project. This extensive project has provided her with learning experience beyond equal and fuelled her love of research. Her own research interests include Workplace Dynamics: Engagement and Burnout.*

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