Redressing the gender imbalance in ICT professions: Toward state-level strategic approaches

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ABSTRACT

This paper reports preliminary work in an ARC Linkage Project involving collaboration among James Cook University, Education Queensland, and Technology One (a Queensland based company). The project aims to identify and interpret factors associated with low female participation rates in Information and Communications Technology (ICT) professional level occupations and education pathways. Data is being collected using qualitative and quantitative methods. A survey is being administered to over 6,000 year 11 and 12 female high school students in Queensland to provide a comprehensive database that will be augmented with individual and focus group interviews. An online survey will be administered to women working in ICT industries. Reference groups representing EQ and ICT industries have been established to provide consultative advice and feedback throughout the project, and to function as working groups during the data analysis and interpretation phases. Project results will inform the development of strategic response options for education systems and ICT industries and suggest further research and industry-based initiatives designed to enhance female participation rates.

BIOGRAPHY

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INTRODUCTION

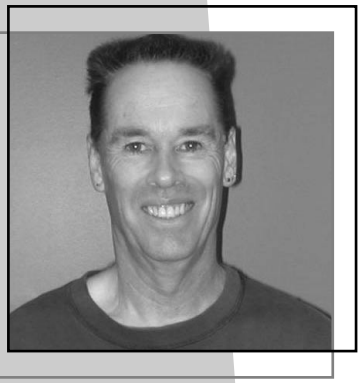
The current paper describes a research project designed to contribute to the development of strategic responses, at the level of an Australian state, to redressing the well-known phenomenon of low female participation rates in professional level ICT occupations. In addition, this paper situates the project in relation to kindred initiatives at the state as well as international and national levels. The venture is funded through the ARC's Linkage Grants Scheme, and involves a research partnership between the state Education Department (EQ), industry and academic researchers at James Cook University. The research milieu is characterised by an array of ongoing and evolving initiatives focusing on girls and ICT in Queensland. Some of these initiatives involve community-based organisations with a focus on girls in ICT, often with ICT industry and/or government funding support. Others involve women's interest groups associated with public and private universities within the state. At the same time, a range of initiatives are being envisaged in accordance with the Queensland Government's 'Smart State' policy direction. Of particular interest to this paper is the growing recognition that a 'whole of state' co-ordinated response is needed in order to plug existing gaps in initiatives and maximise the effects of individual responses.

The paper begins with an overview of the international trend toward low and falling participation rates by females relative to males in ICT courses and professions – including specific reference to the Australian scene. This is followed by a brief synopsis of the main factors reported in the literature as being associated with relatively low female participation, and then with an overview of recent and current responses to the issue on the part of different players in Queensland. The paper concludes with a statement of progress in the project to date and reports results from the pilot study phase of a survey questionnaire.

Female participation rates in ICT: An international issue

An extensive and well-established empirical research base documents disproportionately low levels of participation by female students in ICT courses at all levels and within professional level ICT career slots, and in countries worldwide. Gilbert (2001) reports that within Australasia, Britain, and North America the relative absence of females intensifies step by step on the scholastic and career ladders (eg, AAUW 2000; Lanius, 2003; Turkle, 2003).

While in a broad sense ICT careers can be understood in terms of work that involves creating, storing, exchanging or using information through the use of new electronic technologies, *professional* ICT careers are much narrower in scope. They include roles like 'designing and developing software and hardware systems; providing technical support for computer and peripheral systems; and creating and managing network systems and databases' (Sandy & Burger, 1999, p.5). These roles subsume the work of



BIOGRAPHY

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computer analysts, programmers, software engineers, computer managers, internet architects, webmasters, learning resources managers, and the like (Millar & Jagger, 2001). While women are well represented in ICT careers in the broad sense, they are disproportionately under-represented in *professional* niches. Reporting the US context at the end of the 1990s, Millar and Jagger (2001, p.61) observed that

> [d]isproportionately high percentages of the women graduates were in lower skilled occupations, such as telephone operators, data processing equipment repairers, telephone installers and repairers, and electronics [and] communications … equipment repairers. There were lower proportions of male graduates in these occupations.

At the same time, many reports and projections indicate *absolute* labour shortfalls for all world regions in ICT industries at professional levels, and the demand for skilled and knowledgeable ICT labour is growing faster than education can produce it. Moreover, in some countries enrolment overall in Computer Science undergraduate degrees is falling. According to a CRA Taulbee Survey (Zweben & Aspray, 2004) enrolment in undergraduate Computer Science programs in the US dropped more than 25% between 2001 and 2003. Hence, what is an equity issue from the particular standpoint of *female participation* is also a *pragmatic* concern with potentially far-reaching implications for the competitive advantage of firms, regions, countries and economic blocs. Addressing factors associated with low female participation in ICT careers and pathways will be part of a larger 'fix' for the field as a whole (Frieze, 2005).

It is, however, the equity issue that concerns us here. At a time when female participation in other science and engineering areas has been growing consistently, the trend has been the opposite in ICT subjects and careers, and the trend is worldwide. According to Coohan (2003, p. 669)

> [i]n most industrialized countries, women appear to be a minority in computer science. Data comparing men's and women's CS education internationally showed that in 1995, men earned twice as many math and CS degrees as women earned in Canada, Germany, Ireland, Japan, Spain and the US.

Reporting data from a comparative study of the UK, USA, Canada, Taiwan, Spain and Ireland, Millar and Jagger (2001) noted that female computing graduates are in decline in all of these countries, with figures in the UK lower than in Ireland and the USA. Furthermore, while claims that disproportionately low (and falling) rates of female participation in ICT professional careers and pathways may be a phenomenon of Western countries, the Ministry of Education statistics in Singapore suggests similar trends.

In the case of Australia, where women researchers have been particularly active in researching the issue (Clayton & Beekhuyzen, 2004; Spencer, 2003; von Hellens, Beekhuyzen & Nielsen, 2005), figures indicate that female participation in tertiary computer science courses fell from 26.2% in 1989 to 19% in 2000 and that female representation in jobs involving ICT stood at 20% (Newmarch, Taylor-Steele, & Cumpston, 2000). This was the last comprehensive Australian study conducted across tertiary institutions and industry. Current Department of Education, Science and Technology data indicate that these figures have not improved to date. Figures cited in March 2005, when Australia's Minister for Communications, Information Technology and the Arts announced members of an Advisory Group to help plan a forthcoming Women in ICT Summit, indicated that women currently comprise 'only about one fifth of the ICT workforce' (Dept of Communications, Information Technology and the Arts website).

Within Queensland more specifically, a government report published in 2003 affirms that only 5% of girls in the final year of secondary school studied the highest level computing subject, Information Processing Technology (IPT) in 2001, and that the proportion of girls doing the subject fell from 26% to 21% between 1998 and 2001. In 1992 just 5.9% of boys and 3.4% of girls took IPT, but whereas by 2001 21% of boys were enrolled in the subject the figure for girls was only 5%. Female enrolment in ICT courses in Technical and Further Education (TAFE) institutions fell from 41% in 1999 to 29% in 2002. Women in TAFE courses are overwhelmingly concentrated in lower level ICT courses (Clark Report, 2003). The percentage of women in university ICT courses increased from 15% to 24% in the 5 years to 2001, but the first year intake dropped to 18.2% in 2002, with the proportion of women employed in computing professions falling from 26% to 22% between 1996 and 2001.

Factors commonly associated with low female participation rates in career pathways and the profession

During the past decade, research into this issue has generated lists – often lengthy – of factors thought to contribute to the well-recognised patterns described above. Some factors are associated with low participation in both pathways (subjects, courses) and careers. Others are seen as more specific to one or the other.

With respect to factors believed to dissuade female students from taking ICT subjects and programs, five are

particularly widely cited. The first is that female students often feel marginal to and/or dominated or intimidated by male students within learning settings (Cisco Systems, 2002; Gurer & Camp, 2002). Self reported low confidence and awareness are sometimes linked to the importance of gaming as a way into feeling at home in computing cultures and the fact that (at least until recently) the majority of commercial games pitched mostly to a male market. Some researchers identify perceptions of a male bias in software generally as the second factor that contributes to turning females away from ICT (Gurer & Camp, 2002; Millar & Jagger, 2001). The third factor involves a relative lack of role models and mentors for females among teachers and peers. This lack is felt keenly in the later years of school as in higher education. In relation to undergraduate courses, Coohan (2003) found that students see peer support as vital for meeting the demands of being a Computer Science major. Peer support

> was important to both male and female students, but women don't have the level of access to same-sex classmates that men have … [I]n CS, not all women were comfortable with relying on male classmates for support … [Some] felt that when they didn't know anyone it was easier to approach another woman (p.671).

The fourth factor is poor knowledge about ICT as a subject, sometimes in conjunction with a sense that ICT and related areas are not pathways to roles and work that bring notable benefit to society. Kahle and Schmidt (2004) found that most of the women they studied 'knew very little about computer science prior to working or taking classes in the … field. It seems as though not being informed is the most important reason why women are not enrolling in computer science' (p. 82). Finally, in the eyes of many female learners ICT subjects have a bad image, being widely seen still as the province of 'nerds' and, more generally, the field is associated with undesirable connotations of 'male culture'.

Low participation rates in professional level occupations are associated with several key factors. Here again, a lack of role models and mentors is widely cited. So are perceptions of the culture – in this case the ICT *work* culture – as aversive for females. Moore, Griffiths and Richardson (2005) describe women's experiences of the ICT workplace as a masculinised domain – too many decisions made at the pub; continuing observations of how unusual it is to see women writing software; sexual harassment; 'gentlemen's club' patronage at meetings; communications problems with men; etc. (Clark Report 2003, p. 24). Similarly, the continuing 'nerdy' image of the industry influences the choices of females (as well, often, of males). Insufficient or inaccurate knowledge about ICT careers is cited as a further reason for girls and young women with the right kinds of aptitudes working in the profession not taking this route (Young, 2002). Jepson and Perl (2002) suggested that mathematically talented girls may not be conscious of their potential in ICT. A further barrier is the perception and, very often, the experience of the profession as demanding and not conducive to attaining a good balance between work and family (Jepson & Perl, 2002).

Armstrong (2005) reports 52% of women study participants stated they worked more hours than they had expected to. This is amplified by findings of other studies (e.g., BCS 2004, p. 4), where women refer to a culture

> of very long hours and dedication, a need to constantly keep skills up to date, and the possibility of being on call 24 hours a day because of technology itself: mobile phones and broadband communications to people's homes.

Toward a strategic response: The case of Queensland

The situation in the state of Queensland is highly interesting in terms of the initiatives being undertaken at diverse levels of activity to address what has formally been recognised as an important social, economic and political issue. The following overview will not do justice to the complexity of the situation, although it will be indicative, and will provide a sufficiently detailed context within which to situate the current research project.

Three dimensions will be identified. First, there are initiatives that address both aspects of the issue of women's representation in ICT: namely, the pathways (subjects, courses, programs) aspect and the professional careers aspect. Second, there are four broad kinds of organisation involved in the initiatives: namely, government, education institutions, industry-based groups and voluntary groups (typically comprising participants from the other three kinds of organisation). Third, there are currently four kinds of initiatives: policy development, research activity, practical initiatives and, most recently, a strong move toward trying to achieve some co-ordination among the players and initiatives.

"Developing Informed and integrated strategies to address low female participation rates in professional ICT careers and pathways": An ARC Linkage Project

The Linkage Projects scheme of ARC aims to promote collaborative research projects between researchers in higher education and industry. Projects must involve interaction between the researchers and actual and potential users of the research outcomes, and industry partners must make a contribution toward the cost and conduct of the research. The scheme seeks to encourage long-term strategic alliances between industry and higher education institutions in order to apply advanced knowledge to problems or to provide opportunities to obtain national economic or social advantage.

In accordance with this intent the project described below entered a collaborative venture with EQ and a Queensland-based company, Technology One, as partners.

Project aim

The project aim has three components:

(a) To identify and interpret factors associated with low female participation rates in ICT professional level occupations and education pathways,

(b) To identify priority strategic response options for EQ and ICT industries, and

(c) To identify potential subsequent research and development activities involving the project partners designed to enhance female participation rates through engaging in collaborative research that mobilises experience, expertise, and research capacity drawn from interest groups directly affected.

BIOGRAPHY

Associate Professor Mary Klein is postgraduate advisor at the Cairns Campus of James Cook University. Her research is mainly in the area of mathematics education at primary and early childhood levels and in teacher education. She writes from a poststructuralist perspective on how teaching/ learning interactions position learners (and teachers) in particular ways with implications for students' agentic participation and identity formation in mathematics. Her recent research and writing is in the area of teacher education generally; researching the elements of classroom and tertiary learning environments that lead to robust understandings and facilitate the construction of inquiring habits of mind.

Project objectives

This aim entails five objectives:

(a) To obtain a rich and extensive Queensland data set for female students at Years 11 and12, and at the point of entry to university study pertaining to their views and decisions about ICT programs and careers.

(b) To develop a comprehensive Queensland data set for female employees within professional level job slots in the ICT industry pertaining to their retrospective and current views and decisions about ICT programs and careers.

(c) To analyze this data in ways that incorporate participant perspectives (e.g., by means of member checks and focused group discussions of preliminary analyses.

(d) To undertake 'applied interpretation' of results by means that involves and reflects perspectives of EQ and ICT industry personnel (by asking what the results of data analysis might imply at the level of practical response within their respective domains).

(e) To identify possibilities and priorities for co-operative, informed cross-sector strategic responses to the issue of low rates of female participation in ICT.

Recent studies continue to reflect a high degree of specialisation and 'piecemealness' as opposed to broad-based and co-ordinated approaches to researching female participation. It tends overwhelmingly to deal with small, localised study populations, with nothing on the scale of an education system. Studies tend to reflect either an industry or an educational perspective (Young, 2003). Studies focussing on girls as students in the school system have typically been treated in isolation from studies concerned with post secondary education and studies of the ICT industry and of women's participation in the industry. Moreover, many studies employ a single issue or single factor approach. For example, studies of female student perceptions of learning environments or their perceptions of ICT as a career option or their level of confidence using ICT.

General approach of the project

The proposed project will combine standard mixed methodology research components (surveys, groups and individual interviews) with an original 'ensemble' of techniques and procedures for collaborative research between academics and a working reference group of industry personnel. This 'ensemble' will include use of a modified form of scenario building (Bigum et al., 1997), data analysis workshop activities (Lankshear & Knobel, 2004), and intensive 'applied interpretation' working sessions (Carr & Kemmis, 1986). The innovative dimension of the project consists in addressing, for the first time, the practical issue of low female participation rates in ICT by involving industry personnel from the two directly affected sectors—Education and ICT—as collaborators in a research process that begins with data collection and ends with strategic action plans informed by different but complementary perspectives (academic researcher, Education system and ICT business/industry). A key working hypothesis is that strategic responses to the problem are more likely to be effective if they are developed by people for whom the data, data analysis, and interpretation that elucidate the problem are meaningful as a consequence of significant collaboration in generating the data base, analysing it and interpreting the results with an applied end in view.

Conceptual and Theoretical Framing

The study will be framed conceptually by 'contexts of learning', 'identity formation' and 'cultural meanings,' in relation to social practices mediated by ICTs. Data collection will focus on obtaining broad and deep information from participants about the relative significance they attach to factors that have been associated with participation in ICT and the meanings they make of these factors. The theoretical framework will draw on current work in three main areas. First, cutting edge theory pertaining to media, gender and identity formation derived from cultural studies, media and communication studies, gender studies and sociology will be employed (e.g., Castells, 1997; Gauntlett, 2003; Kenway & Nixon, 1999). Second, theoretical work in feminist epistemology and responses to that work will inform data collection and analysis (Bell & Klein, 1996; Spender, 1996). Third, informed by compelling recent work by James Gee (2003) on 'what video games have to teach us about learning and literacy', the study will relate theory from the fields of situated cognition, connectionism, and sociocultural research. Gee's work is particularly relevant to this study. He identifies principles of learning that are built into good video games (ones designed 'to enhance getting themselves learned,' (p. 11), but that are conspicuously marginal, and typically absent, in classroom teaching and learning. Moreover, he argues that girls and women are 'quickly catching up with the boys and men' (p. 18) in playing video games—issues of sexism and violence notwithstanding. Understanding cultural, cognitive and gender aspects of learning and engagement with technology along lines advocated by Gee provides fruitful ways of thinking about the present issue and envisaging possibilities for strategic responses within education and the ICT industry.

Project design and methods

(a) **Data collection:** Data will be collected from purposively selected samples of female students in

Years 11 and 12 in Queensland schools and female employees in professional level ICT jobs. Two populations of female students, approximating to 'typicality' by socio-economic status, location, and school type (single/mixed sex; state/private) will be identified: those taking Board Level ICT subjects ('takers') and those who are not ('non takers'). One Year 12 'cohort sample' was to be surveyed as near as possible to the end of the 2004 school year with respect to their likely choice of university programs (see below). The second Year 12 and Year 11 cohorts are to be surveyed and interviewed during the 2005 school year. Advice will be sought from students to assist with development and refinement of data collection instruments. Three kinds of data collection instruments will be used, with appropriate variations for the school student and ICT industry employees respectively.

(b) To obtain a comprehensive data base, survey targets of 350 'takers' for each of years 11 and 12 and 1250 'non takers' for each of years 11 and 12 will be pursued, using a system of 'reserve' data collection sites designed to maintain typicality of the sample until targets are reached (Kent, 2001). A purposive survey sample of 150 female employees spanning the range of professional occupation types will be drawn from large, medium and small-sized ICT companies in Queensland.

(c) Individual interviews will be used to explore 'outlier', 'interesting' and 'common' or 'popular' responses from the surveys in greater depth. So far as is appropriate, a standard interview format and schedule will be used to explore high incidence responses in surveys. Variations in format and schedule will be used with respondents whose surveys yielded answers that were statistically unusual, or deemed intriguing and potentially fruitful for deeper exploration. 45 minutes maximum will be allowed for interviews, with an expected norm of 30 minutes. Purposive selections of 50 participants from the schools and 10 from ICT companies will be made on the basis of preliminary analysis of the survey responses.

(d) Focus group interviews (45 minutes maximum) will be conducted with members of the purposive samples who can conveniently be mobilised at given times and places. These will maximise richness of responses through the stimulation offered by varying participant perspectives. Focus groups will comprise a mix of participants who have provided individual interviews and those who have not, using the same criteria identified in (b) above. Ten focus group interviews will be conducted with school participants and 2 with company employees.

(e) **Data analysis:** Surveys will be analysed using a combination of basic statistical procedures drawn from quantitative research and forms of content and categorical analysis used in qualitative research. With respect to the former, ordered categories of data (e.g., Likert items) will be upgraded as far as possible to interval data to facilitate preliminary analysis of data by computer (e.g., SPSS). Means will be plotted to assign levels of significance to factors most frequently associated with taking and not taking ICT subjects and courses respectively. To complement this approach, more open-ended item responses will be analysed by content and categories to further identify and delineate in preliminary ways the broad patterns that will emerge within the large data set. These patterns, together with particularly interesting 'outliers' and minority responses will guide the selection of interview participants as well as the development of items and themes to be addressed in the individual and group interviews.

Interview data will be analysed using techniques drawn mainly from ethnography, including pattern matching (Yin, 2002) and domain and taxonomic analysis (Borgatti, 1999; LeCompte & Schensul, 1999). A form of discourse analysis known as I-statement (Identity-statement) analysis, which has been used very effectively for comparable purposes to those of the present study (Gee, 2000), will also be used. I-Statement analysis is a specific tool within discourse analysis that allows researchers to describe the sense participants are making of themselves in relation to other aspects of the world and social practice. These analytic approaches are preferred to alternatives like open coding and categorical analysis because the latter tend to take chunks of transcribed text out of their contexts, thereby running the risk of missing potentially important links that participants might make between different items of information in their interviews.

Industry 'working reference groups': establishment, purpose, training and operation

Integral to the research design is the establishment of reference groups representing EQ and the ICT industries sector respectively. These will function as working groups during the data analysis and applied interpretation phases, and as reference groups providing consultative advice and feedback throughout the project. Initially the reference groups will facilitate data collection. In their capacity as working groups they will receive pre-circulated material from the chief investigators at key points during the analysis and interpretation phases and meet for half and/or full day working sessions on the data and results with researchers. The non-formal training component will involve the chief investigators actively modelling research procedures to the working groups as appropriate for the work at hand, and the members of the respective industry groups modelling procedures in which they are experts to each other and the chief investigators. These will include aspects of decision-making, policy development, prioritising, and the like that are part of their respective cultures, relevant to achieving the project outcomes, yet outside the experiences and perspectives of the chief investigators and, in some cases, of the other industry partners.

It is envisaged that a key outcome of the project will be the development of ongoing commitments to collaborative work between the parties and, in particular, to maintain co-operation between the two industry sectors to mutually inform their respective work in the problem area. A minimum of two working sessions on data analysis, and four working sessions on interpreting the study findings as a set of strategic responses, are planned.

The work of the EQ reference group to assist data collection will be vital, since it is anticipated that a minimum of 40-50 Year 11

and 12 classes will be required for survey purposes to meet the desired targets. Although smaller target sizes (as little as half the numbers proposed here) are considered viable for statistically valid survey research (Kent, 2001), the larger targets will ensure a rich pool from which participants can be selected for interviews. The quality and range of interview data generated by this project will be one of its major contributions and will set it apart from all published work in the field to date.

Potential role and place of project within the state level coordinated strategic effort

Within the range of initiatives concerned with female participation in ICT professional careers and pathways underway in Queensland, this project will play a distinctive role. It will provide a data base of survey and qualitative data that is unprecedented on the state scale. Participating schools will yield survey data from a pool in excess of 6,000 female students at Years 11 and 12. This should allow for the sample numbers in the study design to be attained easily and, probably, to be surpassed. The web survey of professional women in ICT occupations in the state will provide a retro-perspective on school subject learning experiences that can be brought into 'conversation' with the current school data obtained, to discern any trends (similarities and/or differences) in data patterns across time – allowing, of course, for possible effects on perceptions of the passage of time.

Potentially the most fruitful dimension of the project, however, will flow from bringing 'industry' partners from the producer and consumer arms of school education together to make analytic sense of the data, and to 'translate' their interpretations of the data into actions in their respective sectors. The research design, therefore, actually instantiates the kind of coordination being sought at the state level, since the project will draw on representatives of precisely those groups who are actively addressing the issue in one way or another. Furthermore, the kind of data to be generated by the project, and the lines of interpretation of findings and their translation into suggestions for practical strategic responses, will further inform extant initiatives within Queensland.

The initial survey: instrument, trial and results

Shortly before the end of the 2004 school year, a nine-item questionnaire was tested with Year 12 female students at four schools (two urban and two rural) in Queensland's far north, with a view to informing the final survey instrument. Most items were forced choice, although short answers responses were sought to further clarify respondents' reasons for taking or not taking ICT subjects. With an excellent response rate, 171 replies were received.

Students who were *not* studying either of the professional career track ICT subjects (known as Board ICT subjects) completed three further questions. One asked them to identify those factors from a set of 16 that influenced their decision not to take the subjects (e.g., 'It didn't suit my timetable', 'The subjects are boring'). An 'other' option was included to pick up additional factors to the 15 forced choices. The remaining questions asked if they intended to go on to full time study after leaving school and, if so, did they intend to study any Information Technology courses.

Students who *were* studying one or both Board subjects completed five further questions. These included a question asking about factors influencing their decision to study the Board subjects (which used the same 15 factors but with positive rather than negatives expressions of the factors – e.g., 'It suited my timetable' 'The subjects are interesting'). The other items asked if they intended to go on to full time study and, if so, whether they would study IT subjects. There were also items asking those who intended to further study IT subjects to identify reasons or factors influencing their decision, and to identify whether they intended to study at university or a TAFE college.

Across the 4 schools, 87% of female students (148 of 171) were not studying a Board ICT subject – the rates of 'non takers' ranged from 91% to 79%. Of the 148 non takers, 52% (77) said they intended full time study the following year – the rates here ranging from 70% to 46% across the 4 schools. Of the 77 students intending to go on to full time study, 12 (or 16%) intended including ICT courses in their further studies. The three factors most frequently cited for not taking Board ICT subjects were: 'The subjects were boring' (45%), 'I'm not interested in computers' (50%) and 'The subject would not be helpful for me in my chosen career path after school' (49%).

Of the 23 students (13%) taking either or both Board subjects, 18 (78%) intended to go on to further study – 15 at university and 3 at TAFE. But of these 18 only 3 students planned to take ICT subjects in their tertiary education courses. Interestingly, two of the three factors most commonly associated with taking Board subjects in Year 12 overlapped (although positively rather than negatively) with the factors most commonly associated with not taking the subjects. 18 (78%) of 'takers' cited 'The subjects are interesting', and 14 (61%) cited 'I am very interested in computers'. The other most commonly associated factor was 'I have a computer at home and often use it'. Eleven (49%) negated the third factor most commonly cited by non takers ('The subject would be helpful in my chosen career after school').

The pilot study provided valuable information for helping shape up the final instrument to be used in the project. Beyond this, however, it suggests that the very reasons most girls do not study ICT subjects concern the same factors that influence some girls to study them. Different populations of girls have opposite perceptions of the same

phenomena. Moreover, the results tenuously affirm findings of other studies that posit multiple factor rather than single factor explanations for low female participation in ICT careers and pathways. Getting beneath these contradictory perceptions suggests a potentially fruitful role for the interview component of the research.

Next steps

Currently, the final survey instrument has been developed and is being sent to 33 schools that have agreed to participate (a majority of the 49 schools that were approached). The schools that have accepted collectively have more than 6,000 Year 11 and 12 female students, and they span the range of major variables the study seeks to cover. These are different SES communities; metropolitan/regional/rural populations; public and private schools (including church-affiliated schools); race-ethnicity; single sex and coeducational schools; and schools with different degrees of access to ICT resources (hardware, software and expertise). Surveying of the student participants and industry participants will be completed in 2005, together with individual and group interviewing of Year 12 students. The interviewing of Year 11 students and industry-based participants will be undertaken as early as possible in 2006. Data analysis and interpretation is beginning in September 2005, with the initial returns of school survey data. Survey data will be organised and undergo preliminary analysis in 2005. This preliminary analysis will provide the basis for selecting interview participants. Data analysis of survey and interview data will continue throughout 2006, with organised data being disseminated to the research partners by March-April 2006. Reporting will be ongoing throughout 2006 and 2007, with formal results and conclusions being made available in reports to ARC and research partners at the end of 2006.

CONCLUSION

The state of Queensland presents an interesting and vibrant context within which to investigate factors associated with low female participation rates in ICT professions and career pathways, and to explore different possibilities for initiatives intended to address the issue. The project described here inhabits a context in which much has already been done and continues to be done. The extent to which it may contribute something worthwhile to understanding and addressing the issue at stake will depend on its capacity to draw constructively on extant initiatives in ways that nonetheless go beyond and augment them. This presents a daunting challenge indeed.

Endnotes

1. This section draws substantially on Minutes of two teleconferences called by Colleen Stieler as part of the state level coordinating initiative described in the following subsection.
2. This section draws substantially on material circulated among parties involved in planning the Girls and ICTs Workshop scheduled for 20-21 November 2006.

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