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Education and career pathways in Information Communication Technology: What are schoolgirls saying?

Michelle Lasen *

School of Education, James Cook University, PO Box 6811, Cairns, QLD 4870, Australia

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ABSTRACT

This paper highlights key themes which emerged from schoolgirls' responses to focus group questions regarding perceptions of Information Communication Technology (ICT) subjects in the Queensland senior secondary curriculum, primarily, Information Processing Technology (IPT) and Information Technology Systems (ITS). The 2006 focus group interviews comprised one component of a 3-year research project seeking to identify factors that deter females from ICT education and career pathways. Focus group data reveal that one barrier to selection of advanced ICT options was girls' experience of junior secondary school ICT subjects which had been typically delivered by teachers with limited expertise and constituted by mundane, repetitive tasks. Further, while Non Takers of senior ICT subjects acknowledged the pervasiveness of ICTs in the workplace, they were disinterested in a specialized ICT career path. Hence, rather than undertake advanced offerings of little relevance to career aspirations, Non Takers perceived that they could continue to hone their skills on a needs basis and, indeed, were routinely and purposefully using computers in their home settings. A lack of understanding of the different foci of IPT (i.e. programming and databases) and ITS (i.e. multimedia and web design) was evident among Non Takers, with many singularly associating senior ICT subjects with programming and other highly technical skills. Both Non Takers and Takers (who in the context of the focus groups were largely Takers of ITS) expressed an aversion to programming. It was the creative aspects of ITS which had attracted Takers to the subject and they were, in fact, enjoying its authentic, problem-based design tasks. Many Non Takers responded positively to interviewers' descriptions of ITS; the subject's broader appeal is evidenced in growing enrolments since its 2000 introduction in the senior curriculum. Findings indicate that schoolgirls' participation in ICT pathways may be well promoted through subjects that position and call for students to engage with ICTs as 'enablers' in diverse, meaningful and creative human contexts.

1. Introduction

The ICT industry is 'hydra-like, difficult to define and highly dynamic' (Timms, Lankshear, Anderson, & Courtney, 2008, p. 156). Rapid technological development of ICTs and resulting changes in skill requirements present 'a complex, moving target' for policy-makers and educational and professional training providers with respect to delivering the skills needed for a knowledge-intensive society (European Commission, 2007, p. 5). As ICTs become increasingly pervasive, a discrete ICT sector is less and less identifiable (European Union ICT Task Force, 2006). For example, in Australia, one-quarter of ICT job placements from November, 2006 to March, 2007 were in 'Government, Defence and Public Safety' sectors; one-fifth of placements were absorbed by 'Financial and Insurance Services' (Coulter, 2007). Unlike the 1980s and 1990s where the main focus was on hiring technical expertise alone, it is now advantageous for ICT professionals to have strong business, project management, problem-solving, negotiation, communication and interpersonal skills (Coonan, 2005; Coulter, 2007). The rapid rate of ICT integration and innovation places increased onus on employers to provide ongoing professional development and training as well as educators to conceptualise the ICT repertoire more broadly, including generic and transferable competencies rather than an exclusive focus on acquiring technical skills which may become obsolete in a short period of time (Meredyth, Russell, Blackwood, Thomas, & Wise, 1999).

* Tel.: +61 07 4042 1351; fax: +61 07 4042 1312.
E-mail address: Michelle.Lasen@jcu.edu.au

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The European Union ICT Task Force (2006, p. 5) highlighted increased capabilities of the next generation of ICTs where 'seamless broadband communication networks span from the personal area to the regional and global area, permitting the delivery of ever-higher volumes of data and services anywhere, anytime'. ICTs are critical to ongoing innovation and economic welfare:

> They are pervasive, embedded and ubiquitous. They have a major impact on new product creation, new product features, process improvement and the creation of systems for services. The technologies underpin all other technology development, are essential to the competitiveness of all industries, facilitate service industries, upgrade efficiencies in commodity industries, and seed new industries (Prime Minister's Science, Engineering and Innovation Council, 2000, p. 4).

ICTs are enabling in other ways as well; they are essential tools in addressing national and global challenges in education, health, demographic change, security and environmental management (Department of Communications, Information Technology & the Arts (DCITA), 2005).

An extensive empirical research base documents disproportionately low levels of female participation in ICT education and careers in a number of post-industrialised nations (Anderson, Klein, & Lankshear, 2005). This trend persists in spite of marked increases in overall female participation in labour force and higher education, evidence of ICT skill shortages, as well as, investment in research and initiatives which seek to specifically redress the gender imbalance in ICT. Given the key role of ICTs in post-industrial, knowledge-based economies and societies, it is important that industry and government are able to draw upon a rich talent pool (DCITA, 2005). It is apparent that females represent a key untapped resource.

1.1. Female ICT labour force and higher education participation for Australia, USA and the UK

Declining numbers of ICT commencements, alongside potential mismatch between supply and demand of specific ICT skills, pose significant labour force challenges to Australian ICT employers across industry and government sectors (Queensland Government, 2006). Table 1 reveals that Australian higher education commencements in 'Information Technology (IT)', particularly that of females, fell in the years between 2002 and 2006, in spite of continued growth in overall and female higher education commencements and even some gains in female participation in the heavily male-dominated field of 'Engineering and Related Technologies'. Female IT commencements for 2006 were well below half of those for 2002. In 2006, females comprised only 19.1% of IT commencements—with slightly stronger representation proportionally at the postgraduate than undergraduate level (Department of Education, Employment and Workplace Relations, 2008)—down from 24.9% in 2002 (Table 1). This was in spite of the fact that females made up 55.3% of higher education commencements across 'All Broad Fields' for that year (Table 1).

Marked female under-representation in ICT-related courses at the higher education level is also evident in other post-industrial nations. In 2002, the National Audit Office (p. 7) reported that 28.5% of 'Mathematical Sciences and Computer Science' students and 15.0% of 'Engineering and Technology' students in England were female. In the USA, females were awarded 23.8% of higher education degrees in the 'Computer Sciences' for 2005, with greater proportional representation at the postgraduate than undergraduate level (Table 2). Analysis of time series data (National Science Board, 2008) confirm that 'many of the gains made in US women's formal computing education achieved by the mid-1980s were lost in subsequent years' (McGrath Cohoon & Aspray, 2006, p. ix). Table 2 shows a 21.9% decline in total 'Computer Sciences' graduates in the decade from 1985 to 1995, impacting females to a greater extent than males. Losses were wholly incurred at the undergraduate level where numbers of female Bachelor's graduates fell by more than one half in that decade. While ground has been subsequently regained—primarily between 1995 and 2000—the number of female Bachelor's graduates in the 'Computer Sciences' for 2005 had not yet eclipsed the comparable figure for 1985.

Gender imbalance is also strongly evident in the ICT industry. In 2007, Australia had approximately 398,500 persons working in what the Australian Bureau of Statistics (ABS) classified as an ICT occupation according to the Australian Standard Classification of Occupations (ASCO). These persons were employed across all sectors of the economy, representing 3.8% of the total labour force (ABS, 2007). Table 3.1 reveals that females comprised well under one-fifth (17.4%) of Australia's ICT labour force for 2007. The majority of the females classified within ICT Groups 1 and 2 were employed as 'Computing Professionals' in that year. While the proportion of females relative to the total number of employees in the Australian ICT sector has changed little since 1999—ranging from 15.0% to 17.4%—percentage growth of female numbers over the most recent period (2005–2007) outstripped that of overall ICT workers for both ICT Groups (Table 3.2).

The USA accounts for approximately 30% of world ICT supply (European Union ICT Task Force, 2006, p. 3). According to von Hellens and Nielsen (2001, p. 47), while females represented 40% of the 1986 'technology-sector' workforce in the USA, that proportion fell to 29% in 1999. Figures from *Women in the Labour Force Databook* (US Department of Labor, 2008) indicate that, in 2007, 25.9% of persons employed within 'Computer and Information Systems Managers' and 'Computer and Mathematical Occupations' categories were female (Table 4). This proportion represented well over one million women; 87.1% of whom were classified in the latter category. Table 4 shows that numbers of female employees fluctuated between years during the period, 2004–2007, with eroding female proportional representation

Table 1
Australian higher education commencements* in Information Technology, Engineering and Related Technologies and All Broad Fields for selected years, 2002–2006. *Source*: Department of Education, Employment and Workplace Relations (2008).

Selected year (% change)	Engineering and Related Technologies		Information Technology (IT)		All Broad Fields (ABF)		% Female IT of Total IT	% Female of Total ABF	%Female IT of Female ABF
	Female	Total	Female	Total	Female	Total			
2002–2006 (% change)	+2.2	+2.9	−55.6	−42.0	+8.4	+6.9			
2002	3176	20,413	7859	31,514	181,373	332,490	24.9	54.6	4.3
2004	3131	21,106	5128	26,042	181,796	336,312	19.7	54.1	2.8
2006	3246	21,012	3488	18,285	196,570	355,427	19.1	55.3	1.8

Undergraduate: Bachelor's, Associate Degree, Advanced Diploma, Diploma, other Undergraduate award courses; Postgraduate: Doctorate, Master's, Postgrad. Qual/Prelim., Grad. Dip., Graduate Certificate.
* Undergraduate and Postgraduate.