DYEING THE PINK COLLAR MAUVE: UNDERSTANDING TECHNICAL COMMUNICATION AS A GENDERED SOLUTION TO LEARNING, CAREER AND INFORMATION TECHNOLOGY DEMANDS

by

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Abstract
This paper presents a gender analysis of information technology (IT) learning and work. It posits that gender continues to function in the power relations of the new knowledge-based society, despite rhetoric of gender-neutrality. Beginning with an overview of demographic and conceptual research, it paints a picture of the IT field of education and work as one gendered as masculine and dominated by men. It further explores gendered styles of learning and problem-solving, specifically in the context of computing, and how these styles can relate to women’s learning and career pathways in the IT field.

The development of more feminized niches within the IT field is presented as a response by some women to the learning, career and IT demands of the knowledge-based society. Technical communication seems to be one of these niches. Using interviews from the study Women’s Alternate and Informal Learning Pathways to Jobs in the Information Technology Sector which is currently underway in Vancouver and Toronto, this paper discusses the learning and work experiences of five women who work or have trained as technical communicators in the Vancouver area. Themes emerging during analysis of these interviews include understanding technology as a tool in a social context; the presence of varied and winding learning and career pathways; the importance of intuition and situated learning; encounters with the so-called “boys’ club” in the IT field; the creation of identity; and the role of passion in educational and career decision-making. The paper concludes with an outline of implications and recommendations for research, education, work and policy.

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CHAPTER 1: 
INTRODUCTION

The mathematician Lady Lovelace (1815-1852), daughter of the English poet Lord Byron and associate of Charles Babbage, is often considered along with Babbage as the inventor of the modern digital computer. American computer scientist Grace Murray Hopper (1906-1992) was a navy officer and mathematician assigned to the computation laboratory at Harvard University where she worked as a programmer in 1944 on the Mark 1, the first large-scale US computer....Throughout the swinging 1960s, there were considerable numbers of women involved in software development, data processing and data entry activities required to support the basement-sized machines then in use. These women were valued for the range of skills and understanding that they brought to the situation....So why, when these large, cumbersome basement-filling machines became the compact, computer equivalent of white goods, did they become toys for the boys? (Ordidge, 1997, p. 30)

Background

Information technology (IT) work constitutes a field of education and employment of increasing size and influence in contemporary knowledge-based economies. As technology has developed and assumed new functions in both large and small organizations and society at large, the IT field has broadened. This has had a paradoxical effect on learning and work: there is both an expansion of specialized educational and training programs to prepare individuals for the technical, high-status work in the field, and an expectation that individuals in generalist, low-status work throughout the economy will acquire and use IT skills in their jobs.

This is precisely what makes it so difficult to define the IT field and the IT worker. From the software programmer to the call centre operator, the database administrator to the website designer, the software engineer to the secretary, IT is a crucial part of the job for almost anyone who spends any time at all working at a desk. As Stanworth (2000) explains, “A basic capability to use information technology is now becoming accepted as a ‘key’ or ‘core’ employment skill, which commentators feel will be needed in almost any job in the future” (p. 23). Those who gain
official IT education, training and credentials, and go on to work in specialized jobs are understood, by themselves and those around them, to be IT workers. For those without formal education and training in IT and with more general job titles, identification as IT workers can be less obvious and more subjectively determined.

While women represent a growing proportion of labour markets and post-secondary graduates in industrialized countries, statistics indicate that they are under-represented in formal computer science programs where IT training has been largely based. Despite the presence of women in technology’s early years as well as contemporary efforts of governments and post-secondary institutions to recruit more women into these education programs, there is both Canadian and international evidence that women’s registration in them has actually dropped in recent years (Millar & Jagger, 2001). Not surprisingly, it has also been reported that women are under-represented across the IT field of work (Millar & Jagger, 2001; Breidenbach, 1997; MacInnis, 2003; Rola, 2003), although there seem to be niches where women are more likely to work. This paper discusses women’s experience across the broad field of IT, then uses original interview data to help explain the development of technical communication as a niche gendered as feminine in a primarily masculinized field.

**Technical Communication as an Occupational Niche in the IT Field**

Just as the breadth and substance of the IT field is still being defined, so too are the boundaries and content of technical communication. According to the Society for Technical Communication, an association of technical communicators in the United States, this work can be as diverse as creating videos, helping to design software programs and websites, researching the needs of so-called “end users” and relaying those to product development staff, and writing
manuals or other texts (Society for Technical Communication, no date). The work of technical communication both lies within and extends beyond the IT field. In the eyes of Statistics Canada, even parts of technical communication within the IT field are considered IT work (e.g., website programming and design); others are considered to be part of the work of publishing, research or teaching (e.g., development of training manuals, research into user needs). This paper focuses on all technical communication work within the IT field, including the strategizing, development and design of websites, and the development and delivery of technical and training resources.

**Defining Gender and Identifying its Relevance**

How women experience phenomena such as learning and work, within and beyond the IT field, and how they understand their experiences point to the operation of gender in society. By “gender” I refer to the classifications of male and female, which are evident throughout historical and across contemporary societies. Qualities and characteristics become attached to males and females, and even apparently neutral objects, behaviours, processes and identities become gendered.

In their article on gendered work patterns in the British IT field, Panteli, Stack and Ramsay (2001) “treat gender as a social process taking the view that gender identity is not created at the point of birth but is continually recreated, endorsed, and modified through an ongoing social construction process” (p. 5). Like all critical analyses, gender analysis is premised on the notion that such group distinctions reflect politically determined, rather than natural, divisions. Like other social dividing points, such as race or class, gender provides a rationale for apportioning social rights, obligations and privileges. Gender is apparent in experience and understanding, and becomes one element of an individual’s identity; at the same time, it cannot
predict experiences, understandings or identities which are also influenced by other social dividers and, presumably, individual differences.

That IT learning and work has been gendered as masculine is evident in the abundance of men studying and working in this field, as well as in the tendency for women who do work in this field to cluster together in certain niches. Panteli, Stack and Ramsay characterize the IT field as a “masculine culture” (p. 11). As they explain,

*What emerges from this literature is that computing may be particularly vulnerable to the stereotyping of female and male role through the ideologies of respective style sand competencies, whether these are accurate or not. If they are descriptors of real differences, then they are accompanied by a devaluation and marginalisation of feminine skills and styles; if they are misplaced, they still brand and help to herd women into ghettoized tasks and positions. (p. 12)*

This paper explores IT learning and work as gendered phenomena, and offers the insights of a small number of women working in the technical communication niche of this field to further our understanding of gender’s continued impact in the new field of IT and the new knowledge-based society.

**Colour-coding the IT Work Wardrobe**

Computers and the IT field have gained a special place in our knowledge-based society. As Turkle and Papert (1990) explain, they are both manifestations of abstract thinking and physical tools. In stereotypical terms, then, information technology might be described as the meeting ground of a high status “white collar” field, and a masculine “blue collar” field. Meanwhile, for many women, IT skills and work are increasingly part of what are regarded as the historically feminized jobs of secretaries and clerks, creating ambiguous relationships between these workers and technology. Despite the masculinization of technology and the IT field, there are women who are acknowledged to be working in that field. On the one hand, women are under-
represented in IT education programs and IT work in general, especially the IT jobs considered most technical (i.e., computer programming, software engineering); on the other hand, women appear to be over-represented in a few areas of the IT field. Technical communication is one such area. During one interview for this study, I asked the participant if she thought of technical communication as a “pink collar” job. “A little bit, yup, yup, a little bit,” Melanie answered, and then went on to say,

_But...I don’t really like thinking about those kinds of labels. I know they need to be talked about because they’re part of our exclusion. But, I mean I did see....One woman who became a mentor for me in technical communications, she had a social work background. She worked for years in social work before she came to technical communications. And she loves it! She absolutely loves it! So....And when I think about, you know, pink collar ghettos and her, the two do not meet. Some people, I suppose, they find it, they stay in it, they go, and maybe it’s less conscious....But some people I’ve met, it’s so conscious, they’re so passionate about what they do....You can’t label that [a ghetto], as far as I’m concerned._

So, part of technical communication is officially construed as belonging in the IT field, and part is construed as falling outside this field. Within the IT field, it involves computing without necessarily requiring computer programming, engineering or systems skills. This is one IT niche in which women are more likely to congregate and, in some places, constitute the majority of the workforce (Selfe and Hawisher, 2002). Not easily labelled as a white, blue or pink collar occupation, technical communication straddles the inside/outside boundary of the IT field. It is, in the complicated, Technicolor® world of work, more like a mauve collar occupational niche.

_The Purpose and Importance of this Study_

Since July 2003, I have been employed as a Research Assistant for Dr. Shauna Butterwick. Dr. Butterwick is one of two principal co-investigators of a case study, entitled Women’s Alternate
and Informal Learning Pathways to Jobs in the Information Technology Sector. Based at The University of British Columbia and A Commitment to Training and Employment for Women (ACTEW) in Toronto, this case study is part of a larger Canadian study network, the Work and Lifelong Learning Research Network (WALL). WALL is coordinated by Dr. David Livingstone at the University of Toronto’s Ontario Institute for Studies in Education, and case study research has been funded by the Social Sciences and Humanities Research Council. In my capacity as Research Assistant, I have conducted and will continue to conduct interviews with women who do IT work in the Vancouver area.

Getting to the root of gender issues in IT-related education and work is important for several reasons, depending on one’s interests and values. Industry representatives and employers might be concerned about the growing shortage of skilled IT workers, especially as IT expands its role as both an industrial sector, and as a constellation of tools and services used throughout society. Organizations of women in the IT field might concentrate on the alienation of women working in that field, and the difficulty faced by young women who choose to embark on an educational and a career path on which they will be greatly outnumbered by men. Feminist scholars and activists, along with female IT students and workers themselves, might focus on any gender bias or inequity which exists in the IT field. Governments might share any or all of these concerns. Finally, research into IT work and workers has tended to exclude much of the technical communications niche. Incorporating this area into the realm of IT work contributes to the creation of a fuller picture of the IT field and its workforce.

The key question for this study asks how a group of women who work in this niche understand their own experiences of work, learning and technology. Furthermore, what is it about technical communication in particular which might either draw women to it or, for other
reasons, become the work of women? How do the experiences of the participants in this study relate to research on gender and the wider IT field? How do they relate to the broader issues of women’s learning and work history, and to public policy? These questions are part of an exploration of theory about and practice in the IT field, and women’s learning and work within it.

**Locating Myself**

During this research, my own understanding of gender, work, learning and technology has undoubtedly influenced how I approach the topic, the literature and the research participants. As I have read existing literature and conducted interviews, it has become clearer to me that I was undertaking this research with a feminist standpoint perspective. This analytical approach is consistent with my longstanding involvement in women’s organizations and communities, and my interest in exploring gender as a factor in experience. This is the initial way in which I locate myself in this research.

Throughout the research process, I have discovered points of similarity between my own experience and the experiences of many women who work in the IT field, especially in the technical communication niche. Like theirs, my own learning and work paths have brought me to places of formal university education, informal learning through community-based workshops and conferences, and situated learning in the workplace, community service and personal networks. During part of my most recent academic work I actually studied in an international online program. Clearly, my academic credentials have combined in important ways with skills and abilities that I have been able to develop either through my formal education or in other ways. With an education based in the social sciences and humanities, I sharpened my writing and
research skills. Through a previous Masters program in Environmental Studies, entirely student-structured, I honed organization, independent problem-solving and critical thinking abilities. Employment in the non-profit sector, in very small organizations where I was often the only full-time staff person, required these skills and abilities rather than a particular knowledge base that I had developed in university. I brought what are often termed “soft” skills into those jobs, and gained more specialized skills and knowledge once in them\(^2\). In a society of increasing specialization, I became a generalist.

This has both extended opportunities and erected barriers to my work. I have the advantage of a graduate-level degree without an occupation-specific credential. In this respect, I can relate to the situation of the majority of women in the IT field who, while they are often formally educated, lack officially recognized, IT-related credentials. As a mature graduate student and a woman whose career has not proceeded along a linear path, I am interested in how other women’s work lives reflect ongoing gender differences and divisions, as well as the strategies that enable them to go against the grain.

The knowledge-based society is filled with that type of paradox. We are surrounded by rhetoric about the importance of lifelong and, increasingly, life-wide learning, which seems incompatible with the persistent assumption of education and career development as a formalized, linear progression. Another paradox surfaces in the rhetoric insisting that employees in the knowledge-based economy increasingly need transferable, “soft” skills, and the reality of a post-secondary system which increasingly seems to promote programs leading to specialized

\[^2\] The distinction between so-called “soft” and “hard” skills is discussed in Chapter 2, on page 43.
credentials over a liberal arts education. Negotiating these contradictory rhetorics and realities seems to be part of life for learners and workers in Canada, and is certainly part of the lives of women working in technical communication and part of my own life.

Finally, the impact of technology on my own learning and work has been profound. Without any formal education in IT, I have learned how to fulfil new expectations in my jobs: designing, authoring and maintaining websites, developing databases, learning software applications, conducting online research, and figuring out the technical and etiquette rules of virtual communication. In this study, I ask questions of identities and understandings of women working in technical communication: Are you an IT worker? Who is an IT worker? As I have reviewed the literature and spoken to participants about these questions, I am aware that the answers that I find have meaning for me in a personal way. They help me understand the identity that I construct for myself as a woman learning and working in today’s Canadian society.

Structure of the Paper

This paper continues with a review of the literature exploring women’s learning and work experience in computer science and the IT field. Although it has tended to focus on computer science educational programs and the computer programming niche of the IT field, this research provides an overview of how technology and IT work have been gendered as masculine, and how women – who do undertake IT learning and work – are associated with a different style of learning and work, even though the use of that style is discouraged. A section on methodology introduces the study conducted as part of this research. The five interviews included in the study deviate from the focus of the literature, as they explore the experiences among women learning and working in the niche of technical communication. The chapter on analysis illustrates how
these five women both reiterate some of the thoughts expressed by women through the literature, and are able to sidestep some of the more unpleasant aspects of IT learning and work by entering the technical communication niche. The final chapter of the paper outlines implications of the literature and this study, and recommendations related to research, learning and work, and policy.
CHAPTER 2: REVIEW OF THE LITERATURE

As a relatively new field of study and work, IT commanded little attention among researchers until the 1990s. Since then, demographers have begun to define and track workers in the IT field, and other researchers have identified and investigated trends apparent in this field. One of those trends is the under-representation of women in many of the IT-related educational programs (i.e., computer science, engineering) and work in the IT field, relative to men. This chapter summarizes literature that outlines the IT field both in Canada and internationally, and explores the apparent gender-related trends apparent in IT education and work. It concludes with a discussion of IT-related rhetoric in our information-based society.

Canadian Demographics: A Snapshot of IT Work and Workers in this Country

Like other industrialized countries, Canada is undergoing a transition in which IT is playing an important and increasing economic and societal role (Bowlby & Langlois 2002; Habtu, 2003). As a relatively new field which has had a sudden and substantial impact on society, IT has become an area of interest for researchers and demographers. As the author of one article examining the IT workforce across Canada explains,

Except for anecdotal evidence, little is known about the people who design, produce, and service the technology we use every day. Who works in these occupations? What is their education? How many women are there? Or immigrants? Do workers in these occupations prefer self-employment? Do they work longer hours, and how much do they earn? In which industries, provinces and urban centres are they concentrated? (Habtu, 2003, p. 5)

Habtu also reminds us that it was only in 2001 that the Canadian Census began collecting information about IT workers, with its inclusion of IT work in the National Occupational Classification for Statistics (Statistics Canada, 2001a). An examination of this classification tool
indicates that IT work is officially considered to be a part of the natural and applied sciences. Census data from 2001 indicate that 2.6 per cent of Canada’s labour force (or approximately 406,700 people) were located in the IT sector\(^3\). Divided into professional and technical occupations, the IT sector classifications include computer engineers (6.9 per cent of the 2001 IT labour force), information systems analysts and consultants (26.2 per cent), database analysts and data administrators (3.5 per cent), software engineers (6.6 per cent), computer programmers and interactive media developers (25.1 per cent), web designers and developers (5.9 per cent), computer and network operators and web technicians (11.8 per cent), user support technicians (12.2 per cent), and systems testing technicians (1.7 per cent) (Habtu, 2003).

Missing from this list and from Habtu’s research into IT work are the technical communication jobs of technical writer, researcher and trainer. While technical writing is included with occupations in art, culture, recreation and sport, specifically in the classification section for writing, translating and public relations professionals (Statistics Canada, 2001b), research and training are included with occupations in social science, education, government service and religion (Statistics Canada, 2001c).

This type of work classification complicates the identification of IT workers. While some credentials and jobs carry titles which clarify their central place in the IT field, others have titles and duties which appear to be more peripheral to the field. Because women are under-represented in the educational and training programs which are most linked to the IT field, 

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\(^3\) There is a distinction made between the IT sector and the IT field. The former refers to jobs located in the companies focused on IT production and service, while the latter refers to jobs whose IT focus is peripheral to a company’s or organization’s primary purpose. Although tools used in this study (see Appendices) tend to use the phrase IT sector, I often substituted the phrase IT field during interviews if I thought that it more clearly described the topic of conversation, and have made every attempt throughout this paper to use these phrases accurately.
specifically computer science and engineering, the issue of who is identified as an IT worker has particular currency. Within their own networks and publications if not in formal research, IT practitioners and organizations have acknowledged their encounters with this problem. As Liam Lahey notes in his *Computing Canada* article,

*Just how many women are working in IT positions seems to be a point under dispute. On one hand, a survey of the Ontario IT labour market by the Information Technology Association of Canada (ITAC) last May revealed that women make up a disproportionately small segment of the IT workforce – only 28 per cent. Statistics Canada, meanwhile, says almost half (46 per cent) of Ontario’s IT workers are women.* (Lahey, 2002, p. 26)

The naming of IT training programs, credentials, work and workers has implications for the recognition of a job’s demands and workers’ skills and knowledge. There are many ways in which demands, skills and knowledge may be recognized formally and informally. Formalized recognition is evident in, for example, earnings and opportunities for career advancement; informal recognition is implied in job security and employee relations practices. As other demographic research shows, issues of recognition surface particularly during downturns in the economy, to which information and communications technology (ICT) seems especially vulnerable. In their review of the “boom and bust” of the computer and telecommunications (CT) industrial sector, which incorporates almost 90% of the wider ICT sector, Bowlby and Langlois (2002) conclude that, “It appears that during economic expansion, employment, and hours worked in the CT sector increase more rapidly than in the total economy; conversely, during economic slowdown, they decrease more rapidly” (p. 13).

Bowlby and Langlois (2002) identify the boom years as 1997 to 2000, and the bust year as 2001. Throughout the boom years, the sector was based in larger urban centres, especially Toronto, Montreal, Ottawa-Gatineau and Vancouver. It was characterized by a workforce with a higher than average formal educational level, in which men were over-represented relative to
other industrial sectors. Over the course of 2001, the bust of the sector had a particularly strong impact on workers with the lowest levels of education and women, as they experienced the greatest threat of job loss (Bowlby & Langlois; Bowlby, 2003). While Bowlby’s most recent article suggests that the sector has emerged from the bust period, it also implies that workers’ educational credentials and sex are important determinants of opportunity in the IT field. Regarding women in the IT sector, Habtu (2003) confirms that women are under-represented in this sector (27 per cent of the IT workforce), and explains that they have both higher than average levels of education (i.e., for all employed women), whether or not this education is in the applied sciences, engineering or mathematics, and lower median earnings (i.e., for workers in the IT sector). Within the IT sector, women are most likely to work as database analysts and data administrators (41.5 per cent of women in the sector), systems testing technicians (40.7 per cent) or web designers and developers (33.1), and are less commonly found in the more generally popular but male-dominated jobs such as systems analysis or computer programming.

How women end up working with IT is related in some way to what they study after high school. At the same time that globalization is bringing a greater emphasis on the importance of credentials, and governments, educational or training institutions and professional associations have attempted to recruit young women into science and technology programs, the proportion of women in Canada who participate in computer science, engineering and other similar technical programs has declined slightly in recent years (Millar & Jagger, 2001). The dean of Humber College’s School of Information Technology in Ontario describes an example of this drop in enrolment: “In the 2000/2001 academic year, 21 per cent of the students at Humber were female. For the current academic year, only 15 per cent of the students enrolled in technology programs are female” (MacInnis, 2003, p. 23). The combination of these factors – classification of IT work
and training programs, women’s under-representation in computer science and other relevant technology programs, and the relative vulnerability of women in the IT labour force – makes the intersection of education, work and gender an important issue in Canada’s IT field.

Women’s Learning and Career Pathways into IT Work

The picture of women engaged in IT education and work in Canada resembles that of women and IT workers in other countries. In their report on a large scale international study of women’s participation in information technology, electronics and communications (ITEC) courses and careers, Millar and Jagger (2001) find that, “Women are generally under-represented among graduates in ITEC-related subjects and this is despite the fact that they form the majority and a growing proportion of university graduates generally” (p. 10). Contrary to the Canadian literature reviewed above, Millar and Jagger note that “women are relatively well represented in ITEC professions among computer analysts/programmers and computer systems managers” (p. 30). It is important to note that their survey includes the electronics and communications fields but excludes many of the IT occupations considered in other IT research, including the occupation of technical communicator which is the focus of this paper. The IT occupations included in their work are limited to computer systems managers, software engineers, and computer analysts/programmers. This narrow presentation of IT occupations and work excludes other niches where women within the IT field are more likely to be found, such as technical communication. Their finding that women are more likely to work as programmers or analysts, rather than as systems managers or software engineers, must be understood within the context of their survey’s limited definitions and boundaries.
Millar and Jagger’s (2001) research makes an important contribution to the published literature because it offers data compiled from a range of countries: the United Kingdom, the United States, Canada, Ireland, Taiwan and Spain. This combination of countries is interesting because they operate with a range of socio-political structures and educational systems. The pervasiveness of gender as an issue in ITEC-related education programs and work across these countries reiterates the universal importance of gender as a social factor.

Two areas of study are particularly associated with preparation for careers in the IT field: computer science (referred to as “computing” in the Millar and Jagger report) and engineering. While the proportion of women graduating from engineering programs seems to be climbing slightly in all six countries except the UK, it remains low in all countries. The proportion of women graduating from computing programs, while slightly higher than the proportion graduating from engineering programs, is declining across these countries (Millar & Jagger, 2001). Woodfield (2000) further distinguishes between degrees earned in British polytechnical institutions offering undergraduate degrees only, and universities which extend the possibility of post-graduate degrees. Although she agrees that women are, overall, under-represented among graduates of IT educational programs, she outlines how women are more likely to complete an IT-related program at a polytechnical institution rather than a university. As she explains,

> females, as a group, become increasingly under-represented in computing...as institutional prestige increases, given the lower status endured by polytechnic universities (or new universities in the UK). Unsurprisingly, this tendency is also to be found in the US where the percentage of women taking computer science classes in the

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4 The report’s authors note that figures for computing are combined with those for mathematics for Spain and Taiwan. The proportion of women graduating from mathematics programs is highest in the US, and Canada, and is relatively low in Taiwan and Spain (even with the addition of the computing studies) and in the UK where it is declining.
more illustrious institutions approaches only half of the national average. (Woodfield, 2000, p. 4)

Three outcomes of women’s under-representation in formal IT education programs have been discussed in the literature. First, with less formal education in subjects leading into the programming and engineering niches of IT work, women are predictably under-represented in the IT field of work, especially in its most narrow conceptions. Secondly, women working in the IT field tend to be clustered in lower paying niches and jobs, typically characterized as requiring the fewest technical skills. Thirdly, women who work in the IT field follow multiple academic and informal or nonformal learning pathways into this field.

Women’s Under-representation in the IT Field

This observation is consistent with Canadian demographic research discussed above, and is almost always noted in international research about IT work. In their study, Millar and Jagger (2001) find that women “are severely under-represented in ITEC occupations in all six countries” (p. 15). This is especially pronounced in the UK for all occupations, and internationally within the IT sector. Narrowing in on IT occupations within the ITEC field, Millar and Jagger present Taiwan as a striking exception. In that country, 1999 statistics indicate that 66 per cent of the workforce in IT Service jobs was female. Excluding Taiwan, women’s presence in IT Service jobs ranged from 21 per cent in Spain to 34 per cent in Ireland (p. 14).

The Tendency to Find Women Clustered in Lower Paying Jobs and Niches

Millar and Jagger’s (2001) work reiterates the Canadian finding of a persistent earnings gap between men and women. This is particularly evident in the UK and the US. In those countries, women in ITEC occupations are relatively well educated but clustered in lower paying occupational niches or, even within the better paying niches, lower paying jobs.
Using the membership of Systers, “a women-only listerv with over 2,500 members in 38 countries” (p. 3), Panteli, Stack and Ramsay (2001) investigate a broader range of IT jobs within the UK. They include, for example, workers such as business analysts, help desk staff, and administrators in their research, although they continue to omit technical communicators. Still, they note that women working within the IT field tend to gravitate into administrative or customer service positions, rather than into the male dominated “‘hardware’-oriented work….Thus it seems that women, even those who make it through the social barriers to enter the computing profession, fall into a version of the kinds of task segregation already familiar in medicine and other professions, and find it difficult generally to get into positions of power, especially outside the ‘appropriate’ areas” (Panteli et al., p. 10). British and American research indicates that women tend to be “over-represented on the [lower salaried] front and help desks of computing organizations” (Woodfield, 2000, p. 6). Furthermore, women’s computing work is generally under-valued, “even after controlling for age, education and experience” (Panteli et al., 2001, p. 7). Millar and Jagger (2001) cite one interviewee’s simple but telling opinion that “it helps to be a man” (p. 30).

The research of Selfe and Hawisher (2002) is unique in its focus on technical communicators in the US. Like the survey research of Turner, Bernt and Pecora (2001), Selfe and Hawisher’s study also involved voluntary responses from members of a listserv, this time restricted to technical communicators. Out of over 4,900 members of the listserv Techwr-l, 55 individuals volunteered to complete what the authors call “literacy autobiographies, self-told personal histories focused around a standard set of questions about family [electronic] literacy practices and values, individual literacy practices and values, and the processes through which they learned to use computers to read and write in computer-based contexts” (Selfe & Hawisher,
p. 235). Their research confirms that technical communication is a feminized niche in the American IT field, citing statistics which indicate that 65 to 70 per cent of the members of the Society for Technical Communication are women (p. 238). Within Canada, Habtu (2003) does not provide data comparing income levels within the various niches of the IT field on the basis of gender, but he does make this telling note about the vulnerability of women and technical communicators in the IT field: “Web designers [who do one type of job in the technical communication niche] also had the lowest median earnings among all IT specialists and experienced the highest unemployment rate” (p. 8).

Women’s Multiple Learning Pathways into the IT Field

Even if women are largely absent in formal IT education programs, they are working in the IT field. As Millar and Jagger (2001) explain,

Contrary to the popular belief that ITEC occupations demand graduate skills in ITEC-related subjects, there are high proportions of people (especially women) in ITEC jobs in the US and the UK who have not received a college education and the majority of graduates in ITEC occupations have not qualified in an ITEC-related subject. Clearly, there is a range of alternative pathways into an ITEC career. (p. 25)

Millar and Jagger’s (2001) conclusion on this point resembles the findings in the online survey research conducted by Turner, Bernt and Pecora (2002). Of the respondents to their online survey who had completed a college degree, 43 per cent had a degree in an IT-related area, and 45 per cent had a degree in an unrelated area. It seems that “the field of information technology is a roadway with many on-ramps” (Turner et al., p. 16).

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5 12 per cent of these respondents did not declare their undergraduate majors.
Although these results continue to illustrate that most women working in the IT field do not rely on formal education to help them develop IT skills and knowledge, they might be presenting a somewhat skewed picture of how many women in the IT field complete IT-related degrees. This was, after all, a voluntary survey of members in a voluntary association. It seems likely that professional networks and commitments are formed more easily and solidly among post-secondary graduates who study and then enter the field together. If this is true, then we could anticipate that the most active members of Systers, those most likely to have seen and responded to Turner, Bernt and Pecora’s survey announcement, are also the members with the most formal IT education.

These findings suggest two possibilities about women’s learning pathways into the IT field: situated or experiential IT-related learning replaces learning in formal academic programs, or women working in the IT field often rely on a more general skill set and knowledge base developed through other types of academic programs. These possibilities are not necessarily mutually exclusive. They might well operate in combination to help women enter the IT field, often without relevant credentials, and help clarify why women tend to cluster in certain occupational niches in the IT field, such as technical communication. Despite the recognition that many women working in the IT field do not have IT-specific educational credentials, this issue and these possible explanations have received little attention among researchers to date, and constitute an important element in this study’s focus.

The research of Selfe and Hawisher (2002) on technical communicators continues to reinforce the role of formal IT education programs in preparing technical communicators for their careers. Even so, they recognize the importance of independently undertaken, situated learning, using the word “resourcefulness” (Selfe & Hawisher, p. 241) to describe older technical
communicators in particular. They outline how some participants gained relevant knowledge and skills “both in college courses and on…[their] own time” (Selfe & Hawisher, p. 268), and observe that “[i]ndividual technical communicators may need to be increasingly active in teaching both themselves and their peers emerging forms of electronic literacy” (p. 267). Despite this observation, they maintain centred on the topic of the subtitle of their article: “Implications for the education of technical communicators”.

As the literature discussed in this section and other existing literature discussed in the remainder of this chapter suggests, the tendency among researchers has been to focus on women who complete formal IT-related education despite the challenges and barriers that they experience. The experiences of women who do not complete such educational programs are nonetheless able to enter the IT field of work remain largely unexplored. I return to that topic in chapter four, which presents an analysis of the interviews conducted for this study. In the meantime, the following section summarizes several approaches to explaining women’s under-representation in IT education and work.

Defining and Addressing Women’s Under-Representation

It was not long ago that girls were perceived as weaker than boys in areas such as mathematics or sciences; however, recent statistics on girls’ achievements in these areas indicate that they are no less capable (Clegg & Mayfield, 1999). The reason for women’s under-representation in educational programs such as computer science has been recast by some researchers as an attitude that Turkle and Papert (1990) characterize as “computer reticent” (p. 135). Others have summed it up in the somewhat defiant statement, “‘I can, but I don’t want to’” (Siann, 1997 in Clegg & Mayfield, 1999, p. 3). Among researchers, educators and policy-makers concerned
about women’s under-representation in IT studies and work, this shift in explanation appears to have been generally accepted. Still, individuals and organizations bring different perspectives to their attempts to address women’s under-representation in IT-specific educational programs and IT work, defining the problem and its solution in distinct ways.

**A Marketing Issue**

In keeping with globalization’s generally liberal interpretation of social problems, which argues that the key to making sound decisions is the provision of adequate information and opportunity, some organizations have focused on marketing IT as a career path for women. Campaigns have been developed by governments, post-secondary institutions and industry, and aimed at girls in school and young women contemplating their further educational and career options. Typically, these strategies attempt to convey information to girls and young women about the wide range of occupations in and educational pathways into the IT field, as well as to dispel the image of IT as a field populated by so-called computer “nerds” or “geeks”. As Karen Lopez, a spokesperson for Canadian Information Processing Society, explains, “Most girls think IT careers are isolating. They’ll work alone, they’ll work in a basement, sit around a glowing terminal and, sometimes, even do evil things” (Rola, 2003, p. 27).

A local study in Vancouver’s public schools surveyed students in grades eight, ten and 12 in 1998 about their impressions of computers and IT work. With a response rate of approximately 56%, the researchers had a sample size of 7,411.\(^6\) This study’s results indicate that the girls surveyed were less interested in the subjects of computer science and engineering than

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\(^6\) The study’s authors caution that, for logistical reasons, it was not possible to use a random sampling process.
the boys were and perceived themselves as less capable in these areas, whereas the boys were more interested in computer science and engineering than other subject areas (Chan, Stafford, Klawe & Chen, 2000). The results also indicate that most of the youth surveyed, but especially girls, were unaware of some of the key skills and personal qualities in demand by IT employers. These include communications skills and being a team player, even though these are regarded as particularly female, rather than male, strengths in North American culture. Among the researchers’ recommendations is “improving parent, student and teacher knowledge of computer-related careers through workshops, job-shadowing, mentoring and the media” (Chan et al.).

Margolis and Fisher (2002) have described what they call the “geek mythology,” adopted even among those who study in computer science programs. In their four-year study with 97 computer science majors and 30 non-majors at Carnegie Mellon University, they find that, while both men and women spoke about a stereotypical computer science student, “a larger number of students than we had expected (both male and female) say this image of the computer science student ‘is not me.’ Contrary to this stereotype, about half of the computer science students we interviewed enjoy computing but also have broad interests and are not glued to their computers” (Margolis & Fisher, 2002, p. 67). Some of the students participating in this study did come close to fitting the computer geek stereotype, but many others did not.

Countering this perception of IT work and the IT worker is the basic task that a marketing approach would set. Examples of large-scale programs which have taken a marketing approach

7 Preliminary papers which form some sections of Margolis and Fisher’s book are available online from the website of the Carnegie Mellon Project on Gender and Computer Science, at http://www.cs.cmu.edu/~gendergap
to defining and resolving the issue include the WISE Campaign – Women in Science and Engineering – in the UK\(^8\), the National Research Council’s Women in Engineering and Science award to develop female role models in Canada (McDill, Mills & Henderson, 2000) or the Women in IT program of the Canadian Information Processing Society\(^9\). These programs typically feature a combination of resources and women ambassadors or mentors who can speak to girls about their rewarding experiences working in the IT field and dispel the “geek mythology”.

Interestingly, Margolis and Fisher (2002) note that, among the computer science majors that they studied, 69 per cent of the women felt that they did not fit the common stereotype of the computer geek, while only 32 per cent of the men saw themselves as outside this stereotype (p. 68). This suggests that there are multiple, often gendered ways of understanding and interacting with computers, and that there is something operating here that a marketing approach cannot resolve.

\textit{A Socialization Issue}

Other attempts to define the issue of gender and IT-related education concentrate on the influence of social values and roles on young people’s educational and career paths. The Silicon Valley Network surveyed 2,500 eighth and eleventh graders in its region. Their findings indicate that, while girls show less knowledge of the range of occupations in the IT field than boys do, “there is an even more significant gender divide with regard to interest in high-tech careers…. The most common reason that female students offered for not wishing to pursue technology

\footnotesize{\textsuperscript{8} Information about the WISE Campaign is available at its website, \url{http://www.wisecampaign.org.uk} \\
\textsuperscript{9} Information about the Canadian Information Processing Society is available at its website, \url{http://www.cips.ca}}
careers was what they view as the uninteresting nature of the field” (Madan, Brown, Schoeneman, Mai, Sethi & Dimler, 2002, p. 18). The authors of this study look to girls’ social networks to help explain why they tend to make the career decisions they do, including the decision not to study computer science or engineering. Parents’ careers, families’ socioeconomic status, peer networks, career planning services in school, and information about IT in the mass media seem to influence the education and career decisions that young people make. In short, the more that youth, including girls and young women, are exposed to positive accounts of and personal relationships with people who do IT work, the more interested they become in pursuing related education.

Turner, Bernt and Pecora (2002) discuss socialization factors in their study of the educational, social and familial influences behind women’s decisions to enter the IT field. Their survey findings suggest that some of the most influential factors in women’s decision to study and work in the IT field are exposure to computers in school; support from teachers, parents (especially fathers), friends, colleagues or bosses; early academic success in mathematics and science; and, especially for the women who studied in IT-related programs, a feeling that IT work presents welcome challenges and opportunities. The researchers note that, for respondents who had completed IT-related academic programs, support from male friends, colleagues, bosses or mentors seemed particularly important in their educational and career decisions.

McDill, Mills and Henderson (2000) list several examples of Canadian projects that have attempted to address women’s under-representation in IT educational programs and occupations using socialization interventions. In the 1980s through the mid 1990s, popular interventions included computer camps and other special programs addressing the gender imbalance. The WISH program – Women Into Science, Hopefully – was operated in the early 1980s by the
Department of Physics at Toronto’s York University. In New Brunswick, the Worlds Abound summer camp offered a gender-balanced environment for children in grades five to eight.

Some projects bring together researchers, educators and industry. One of these, the GenTech Project, “studies non-school based environments in which women experience unusual levels of success with ICTs. The results of this are fed into the development of a model for the implementation of ‘micro-climates’ within schools that is encouraging and supportive for girls and their female teachers” (Millar & Jagger, 2001, p. 23). A collaborative undertaking of The University of British Columbia, Simon Fraser University, the Richmond School District and Hewlett-Packard (Canada), funded by the Social Sciences and Humanities Research Council, the GenTech Project opened a “Girls First” computer centre at one Richmond elementary school, offered learning opportunities to students and staff in website design and multi-media authoring, and developed an on-line guide for GenTech teachers and a project website for other educators and the general public (Millar & Jagger).

A Gender Politics Issue

The GenTech Project has been described as taking a “gender and pro-female perspective” (Millar & Jagger, 2001, p. 23) in its work. While it acknowledges the impact of gender preferences, roles and stereotypes on women’s choices around IT education and work, it does not go so far as to challenge societal and organizational politics and power structures. Focusing on the WISE program in the UK, Henwood (1998) outlines the problem with attempts to overcome the gender imbalance in IT education and work by trying to better inform women about the IT field and to

10 Information about the GenTech Project is available online at http://www.educ.sfu.ca/gentech
socialize them towards, rather than away from, this field. Looking through a feminist lens, she asserts in a later article that this issue has been repeated in other fields and is a longstanding example of gender politics at play: “historically, male workers have managed to have their work defined as skilled, even when the content resembles women’s work, which is invariably defined as unskilled or semi-skilled…. In this way a hierarchical gender structure is reproduced in the workplace, with men’s work carrying more status than women’s” (Henwood, 2000, p. 211).

Contrary to the marketing and socialization approaches, an approach concerned with gender politics understands technology as part of a society in which everything is gendered. A marketing approach de-genders IT by presenting it as entirely gender-neutral, while a socialization approach de-genders women by proposing an alternate socialization process for girls. A gender politics analysis of IT learning and work looks at how both girls and boys are socialized, looks beyond the differences in their socialization, and highlights how gendered qualities and preferences are valued differently to privilege some (i.e., boys and men) over others (i.e., girls and women). It offers a critique of the “deficit model of women and girls” (Henwood, 2000, p. 210) foundational to the marketing and socialization approaches discussed above.

Feminist critiques first outline the popular discourse which masculinizes technology itself. Woodfield (2000) comments on the aggressive vocabulary of computing, an example of a masculine IT culture. “Frequently cited in support of this is the essentially ‘anti-social’ imagery of computing games and programs, including the use of combative themes and aggressive terminology such as ‘abort’ and ‘crash’ which have been blamed for alienating female interest,” she says (p. 23). In her analysis of ICT, Clegg (2001) details how shifts in the computer’s purpose from a military-based instrument to a part of formal education from elementary school
onwards, and from a role as problem-solver to one as plaything primarily for boys, help explain how technology has become gendered as masculine.

This new purpose and role of computers and IT is solidified in a cyclical way by young people’s exposure to existing software, including games, and by experiences with curricula of the computer science courses in which IT learning is formalized and expertise in the field is seen to be rooted. In Clegg’s (2001) words, “The dominant discourse in computing is shaped by social practices which have institutionalized the power of experts, mostly male, to define what counts as computing in education” (p. 308). In this discourse, women’s under-representation in IT education programs and work is attributed to their natural inabilities to succeed in working with IT. The work of sophisticated computing is seen as a naturally male activity. This discourse is solidified in educational programs which objectify IT work, defining it as a scientific discipline rather than a subject which can be successfully taught in an inter-disciplinary context. Underpinning this discourse is a behavioural pattern described by researchers such as Turkle and Papert (1990), Henwood (2000) and Woodfield (2000), in which boys and men talk about and use computers singularly and almost obsessively, while girls and women talk about and use computers as a way of connecting diverse interests. Men’s tendency towards “constructing and controlling elements in a virtual universe” (Woodfield, p. 91) is an example of patriarchy operating in educational systems, the workplace and society in general. It is an example of how men continue to exert control over the tools of work and the work environment itself.

Other research discusses barriers to women’s participation in IT education and work that are linked to gender roles outside work. A commonly noted issue is the absence of work-life balance, particularly important to women who have tended to retain responsibility for providing informal care for children, elders and the family in general, whether or not they are engaged in
paid work. For women throughout the labour force, this issue is complicated by maternity leaves and child rearing responsibilities, sporadic retreat from paid work, the option of part-time rather than full-time employment, and reluctance to relocate for career advancement. In a fast-moving field like IT, currency of skills, knowledge and experience is an important consideration, as is the common expectation that staff will work long hours in order to meet project deadlines (Panteli et al., 2001; Millar & Jagger, 2001). According to one interview segment from the Millar and Jagger (2001) study, presented as a fairly common view, “The industry is not women friendly. There are long hours, early starts, late nights, a lot of travel. It’s not family friendly, not socially friendly. There’s still a macho thing about it” (p. 29).

If women’s under-representation in IT educational programs and work is problematic, the solution is not limited to persuading women to see themselves differently and adopt new roles. It extends to challenging how both women and men see themselves and are seen in society, and changing the way IT education and work is conceptualized and structured so that women’s contributions can be valued equally with men’s. This is the conclusion reached by the commission struck by the American Association of University Women (AAUW, 2000) to study girls and computers:

In its inquiries into gender issues in computers and education, the commission found that girls are concerned about the passivity of their interactions with the computers as a “tool”; they reject the violence, redundancy, and tedium of computer games; and they dislike narrowly and technically focused programming classes. Too often these concerns are dismissed as symptoms of anxiety of incompetence that will diminish once girls “catch up” with the technology.

The commission sees it differently: In some important ways, the computer culture would do well to catch up with the girls. In other words, girls are pointing to important deficits in the technology and the culture in which it is embedded that need to be integrated into our general thinking about computers and education. Indeed, girls’ critiques resonate with the concerns of a much larger population of reticent users. The commission believes that girls’ legitimate concerns should focus our attention on
changing the software, the way computer science is taught, and the goals we have for using computer technology.

Research outlined above clarifies the diversity in the IT field and the range of learning pathways that lead into it. Most of the research adopting a deeper, more political analysis focuses on programming as a niche where the gender divides are most blatant, rather than niches like technical communication where women are more likely to work. This research focus might stem from women’s extreme under-representation in the IT-related educational programs and, later, in the relevant occupational niche, or from an attempt to research a niche which is inarguably part of the IT field. It is these more political approaches which take us to a feminist standpoint analysis of gender differences and divides in the IT field of education and work, as it focuses our attention on how women come to know computers and IT work and on how women’s ways of knowing are overlooked and devalued.

**Studying Women’s Ways of Learning, Knowing and Working with IT**

Differences between girls and boys in their levels of interest in computers are evident from childhood onwards (McDill, Mills & Henderson, 2000; Millar & Jagger, 2001; Panteli, Stack & Ramsay, 2001; Turkle & Papert, 1990; Woodfield, 2000). In their summary of Canadian research conducted in the late 1980s and 1990s, McDill, Mills and Henderson report that “the gender barrier becomes a significant factor in the lives of girls as early as age 9 and is firmly in place by age 13” (p. 2). It seems that women’s IT learning and work pathways begin very early in life, and help explain the educational and career decisions made in later years. Feminist researchers attribute these early and persistent gender differences in computing to different styles of knowing and learning.
Several empirical studies on this topic have been conducted by Turkle and Papert (1990), Margolis and Fisher (2002), Henwood (2000), and Woodfield (2000). Turkle and Papert’s (1990) relatively early research in this area explores “how people enter the culture of programming” (p. 131), and the different styles of programming that they prefer. Studying elementary school students using computers in school and Harvard University students enrolled in an introductory programming course, they found differences in how girls and boys feel about and interact with computers from an early age.

In writing up their research, Turkle and Papert (1990) introduce the application of Levi-Strauss’ term “bricolage” to IT learning and work. In contrast to what they describe as “planners,” people who prefer to learn and solve problems systematically and formulaically, “bricoleurs” go about learning and solving problems by working with others – both humans and machines. They start off with an acknowledgement of the unpredictability of learning and are more comfortable with a trial-and-error, give-and-take, back-and-forth way of learning. Planners engage in rule-bound learning and problem-solving; bricoleurs engage in experiential learning and problem-solving.

Turkle and Papert’s (1990) characterization is both useful and problematic. While it clearly contrasts initial styles or strategies of knowing, learning and working, it also reflects a stereotypical, outdated understanding of planning. Contemporary approaches to planning are more fluid and flexible. This problem might reveal Turkle and Papert’s lack of familiarity with planning theories and processes, and it is a reminder of keystone, critical research has limitations and, over time, becomes dated.

While Turkle and Papert (1990) recognize that both boys and girls, men and women may use either of these strategies, bricolage is more commonly considered a feminine strategy. Millar
and Jagger (2001) refer to research in the workplace which “has indicated that men and women react differently to particular learning experiences. For example, women appear to adopt a bricoleur approach to problem solving in order to try to piece together a solution from various sub-components. In contrast, men tend to adopt a linear, hierarchical and planned approach to problem solving” (p. 30).

A similar understanding of bricolage is presented in Orr’s (1996) study on Xerox technicians. Contrary to the corporate view that solutions were to be found by pursuing a sequential, technologically-based approach, technicians found that they used a combination of cues from the technology, the people who used it, and their own previous repair experiences. In this way, a triangular relationship between technicians, technology and customers was created, with each point in the triangle becoming an important source of both theoretical information (i.e., how machines are supposed to work and how technical problems are supposed to be solved) and concrete information (i.e., how machines actually perform and how technical problems might actually be resolved). Because machines display individual quirks depending on their construction and use, even mechanical problems cannot always be resolved in a predictable way. Bricolage in this context of Orr’s study is constituted by technicians’ reliance on technical knowledge, relevant experience and, most interesting to Orr, work-related stories generated and shared by technicians to fill the gaps in these other sources of information.

In Turkle and Papert’s (1990) research, bricolage is contrasted with abstraction. Some participants in their study, most often men, preferred to use pre-packaged tools as a starting point for building sophisticated programs, while others, most often women, preferred to undertake the programming process from the very beginning. Men in computer programming courses were more likely to be comfortable trusting an epistemology that guides them through what remains
an exercise in abstraction. Women, on the other hand, more often preferred to go back to square one, to establish “transparency” (p. 133) throughout the programming exercise and anchor it in the experience of everyday life. Unlike Orr’s (1996) point that the technicians whom he studied could not avoid a bricolage approach in their problem-solving, Turkle and Papert’s point is that, in a setting which encourages an abstract approach to problem-solving, men seem to be more comfortable than women.

The implication here is not that women, as a group, are interested in figuring out the building blocks of computing; it is rather that women, as a group, seem more interested than men in finding a way to relate their work – whatever that is – to the concrete reality of the everyday. According to Turkle and Papert (1990), IT provides a unique context in which to study gender differences in epistemological styles, what they call an “epistemological pluralism” (p. 129). As they explain, “The computer, with its graphics, its sounds, its text, and its animation, can provide a port of entry for people whose chief ways of relating to the world are through movement, intuition, and visual impression” (Turkle & Papert, p. 131). Turkle and Papert also note, however, that the course studied in this research emphasized a different approach, and “taught that there is only one right way to approach the computer, a way that emphasizes control through structure and planning” (p. 134). Some of the female participants in their study describe their responses to this sense of being outside the cultural norm, and feeling pressured to work in a particular way. One woman spoke of having to turn “‘herself into a different kind of person’ in order to perform” and another talked of learning to “‘fake it’” (pp. 134 & 135).

Margolis and Fisher (2002) assert a similar explanation of gender differences in IT education and work. Again, they outline differences between girls and boys from the early days of their exposure to computers:
Despite the rapid changes in technology and some fifteen years of literature covering the era of the ubiquitous personal computer, a remarkably consistent picture emerges: more boys than girls experience an early passionate attachment to computers, whereas for girls attachment is muted and is “one interest of many.” These attachment differences help to shape students’, parents’, and teachers’ expectations that boys and men, not girls and women, will excel in and enjoy computing. (p. 16)

What is important here is that, not only do girls typically display a different type of interest in and interaction with technology, their interests and interactions are devalued as the school system launches the formalization of a particular – and a particularly masculine – way of understanding and using computers. In their study of students at Carnegie Mellon University, Margolis and Fisher reiterate many of Turkle and Papert’s (1990) findings. They use the phrase “magnetic attraction” (Margolis & Fisher, p. 16) to describe boys’ early and concerted interest in computers. They further note that, even if girls were interested in computers, they were more likely to watch “from the sidelines” (Margolis & Fisher, p. 19) as other people – often older brothers or fathers – used computers. Male participants also reported having had more frequent early mentorship from fathers who had computing skills; encouragement for girls in computing tended to come later, in high school, when computer science courses were offered.

Margolis and Fisher (2002) cite other research on experiences which tend to exacerbate girls’ and women’s exclusion from computing. Studying high school students, Schofield (1995 in Margolis and Fisher) describes how the computing “brainiacs” claimed the space of the school computer laboratories as “an important sanctuary for these kids at a time when the dominant high school culture is obsessively concerned with appearance over substance and it is often ‘uncool’ for boys as well as girls to be too smart” (Margolis & Fisher, p. 35). Schofield further describes incidents of harassment by boys of the few girls in advanced computer science courses, often unaddressed by teachers. Such experiences in childhood and early adulthood surely influence
women’s later educational and career decisions, and reinforce already different epistemological and learning styles.

Among the female participants majoring in computer science, Margolis and Fisher (2002) find diverse interests and explanations for their educational choice. They refer to this diversity as a “‘counternarrative’ to the stereotype of computer scientists who are narrowly focused on their machines and are hacking for hacking’s sake. Instead, these women tell us about their multiple interests and their desire to link computer science to social concerns and caring for people” (Margolis & Fisher, p. 54). On the topic of programming, “both women and men find pleasure in areas beyond the traditional quantitative programming lexicon…. Love of puzzles, creating something from nothing, the art of thinking, interaction, communication: all are facets of the computing endeavour but not always part of the traditional lexicon” (Margolis & Fisher, pp. 57 & 58). Still, male programmers in this study remained more likely to focus on getting the program to work, whether or not it had any practical application or usefulness.

At the same time as statistics indicate that women’s enrolment in computer science programs has been falling internationally, including in the US, Carnegie Mellon University was able to increase the representation of women in their program over the period of Margolis and Fisher’s study. Beginning in 1995 with women taking seven per cent of the places and ending in 2000 when women took 42 per cent of the places, Carnegie Mellon made a series of admissions and curriculum changes to address the gender differences described by the researchers. Margolis and Fisher (2002) outline the following revisions, which were considered successful:

- Admissions criteria were revised so that a lack of prior computing experience did not preclude acceptance into the program.
The first-year curriculum was revised, and four different options were developed for incoming students, depending on their prior experience. By the end of the first year, students who had entered the program with less experience had gained skills and confidence. The authors found that this intervention “increased levels of satisfaction among both more and less experienced students of both genders and indeed seemed to result in the smooth integration of the less experienced into the remainder of the curriculum” (p. 130).

Teaching assignments were juggled, “to put better, more experienced and more senior teachers (note that these are not always correlated!) into the earliest courses of the curriculum, where women reported having the most distress” (p. 131).

Computer science was re-contextualized as situated in real-world, rather than classroom or laboratory, settings. Interdisciplinarity was introduced, team work was emphasized, and diverse learning styles were better accommodated by the incorporation of different problems and teaching methods. A software engineering course, for example, was redesigned so that it created a simulated software development team, including technical writers and marketing students.

Discussion sessions were held with faculty, to build awareness of the cultural barriers faced by women who are interested in IT education and work.

Margolis and Fisher (2002) also note that some interventions were not considered effective in boosting women’s enrolment in the computer science program. Recruitment techniques targeting potential female students and using female faculty showed, at best, only a small impact. Efforts to develop a female students’ network were also stymied. Surprised at this outcome, the authors explain it this way:
We may have never hit on the right formula for this style of activity, but we are inclined to believe that the limiting factor was the lack of a critical mass of women, resulting in a shortage of new leaders to take the place of those who left. Increases in the enrolment of women and the arrival of new faculty leadership have led to recent progress in this area. (p. 135)

Borrowing from the writing of feminist Carol Gilligan, Margolis and Fisher conclude that this research and these educational changes might help to change “the conversation in computer science” (p. 143) so that women’s learning and work styles become part of the talk and the practice.

Henwood’s (2000) smaller-scale study of two introductory, undergraduate courses delivered at different London universities provides an interesting contrast to the learning from the Margolis and Fisher study. One course in this study was a conventional computer science course and the other was an interdisciplinary IT course. Henwood notes that the interdisciplinary course “deliberately set out to attract women students by combining technical skills acquisition with an exploration of the social, including gender, relations of technology…. Thus, the participants comprised two groups of students, studying computing in two very different contexts or cultures” (p. 213). Using observations, a questionnaire and interviews of a group of students in each course, Henwood concludes that IT was conceptualized differently in these courses. The conventional course focused on providing an education which would respond to industry needs, and emphasized the university’s technical facilities and the specific software program languages and skills that students would gain while in the program. It presented technical tasks such as programming and systems analysis as separate from other IT work, and technical workers such as programmers and analysts as separated from other IT workers. Alternatively, the interdisciplinary course presented IT as “technologies within innovation processes in which ‘social, political, cultural, economic and technical factors are interwoven’” (Henwood, p. 215). It
emphasized “evaluation, as well as the construction of technologies…in the context of their use and with user needs and requirements always in focus” (Henwood, p. 215). Henwood describes the approach taken in the conventional course as “technical” and the approach in the interdisciplinary course as “social,” in a distinction similar to Turkle and Papert’s (1990) of planning and bricolage.

While we might have expected differences in women’s experiences in these two courses, the findings from Henwood’s (2000) study suggest that gender exerts a stubborn influence on students within either a conventional curriculum or a more progressive, critical curriculum. Male students in this study tended to have more self-confidence in programming than female students did, and were more often credited with technical expertise even when they received lower grades in either of the courses under study. The women described by their instructors as expert in programming still tended to under-estimate their capabilities. In the interdisciplinary course, male students showed their disapproval of an optional women-only segment on Women in Technology. Henwood outlines the reaction of some of the male students, who “were perceived by the women taking the option to be trying to undermine their choice by suggesting it was the option for ‘lesbians’” (p. 221). Even when their program incorporated the more critical curriculum, students – both female and male – still had to contend with gender stereotypes and political tensions.

These findings appear to dilute the results of Margolis and Fisher’s (2002) study; however, these dissimilarities can be qualified somewhat. First, Henwood’s study involved a
very small sample and occurred over a single academic year, a much shorter period than Margolis and Fisher’s multi-year study. The development of students’ attitudes and behaviour beyond their introductory year remains unknown. Secondly, Henwood’s study was conducted in the UK, as opposed to Margolis and Fisher’s study which was conducted in the US. As Millar and Jagger (2001) point out, the UK is notable internationally for the extreme gender disparity in its IT field. As a nation, it has a particularly great challenge in understanding and addressing the cultural and political issues relevant to women’s lack of participation in IT education and work.

A fourth study exploring the issue of gender in the IT field was conducted by Woodfield (2000), also in the UK. Unlike the previously summarized studies, this research moved beyond the confines of the academy, into a workplace. Her ethnographic study was based in the research and development unit of a British corporation providing software development and systems integration products and services. Woodfield notes that a relatively high proportion of female staff in her research site held scientific degrees, primarily in computer science, mathematics, engineering, electronics or physics (p. 90).

Despite the presence of an uncommonly high proportion of women with science degrees, the workplace studied by Woodfield (2000) displayed anticipated gender differences. Once again, women tended to describe their interest in computers and technology as only one of several interests, while men described a now familiar type of obsessive interest in computers. Female participants were more often described by in-house instructors as being better able to adopt the corporation’s newly preferred strategy of seeing “the broader picture” in their problem-

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11 There were five women and nine men in the conventional computer science group, and five women and seven men in the interdisciplinary course group.
solving, in contrast to male participants who were more often seen as remaining narrowly focused on “software solutions which grew out of specific technical detail” (Woodfield, p. 98). The instructors also appreciated the relative ease with which women were able to share credit for successful problem-solving with colleagues.

Gendered as feminine, these qualities and characteristics were both encouraged by official corporate discourse of the hybrid worker and discouraged by corporate practice of continuing to favour male employees. Informally, such favour was illustrated through male employees’ tendency to revert to a more traditional gender-based understanding of technical expertise as masculine and a separation of technical knowledge from social context, especially during time-sensitive, high pressure projects. Formally, the most striking illustration of traditional male privilege was the promotion patterns. Woodfield (2000) notes that managers seemed willing to take more risks with men than they were with women. Women were given fewer project and staff management responsibilities and, ultimately, “male recruits seem to have been given the chance to try their hand at management earlier” (Woodfield, p. 117). For at least two female employees, the promotion of an unqualified male employee into a management position so disturbed team morale and functioning that they resigned (Woodfield, p. 118).

Woodfield (2000) makes several important points in her analysis of the impact of gender on IT work and workers. First, corporate discourse around a relaxed atmosphere, a system of meritocracy and an engagement of all workers in decision-making initially attracted both women and men into this workplace. That discourse was contrasted, particularly by women, with the reality of traditional gender-based hierarchies known to be common in other IT corporations. While the women were typically thankful for the in-house orientation and training which emphasized the value of the “hybrid” worker and a broad perspective, they tended to become
sceptical about the corporate commitment to these progressive differences within their first year on staff. In general, the women recognized

their own idiosyncrasies (some of which were confessed failings) as contributory factors in their inability to thrive within the context of the learning style, [but] ... felt strongly that their comparative unease had much to do with their gender. They linked their negative experiences to the development of a culture around the design process which favoured what they identified as a specifically ‘masculine approach’. The approach was characterised as one which had developed out of the ‘feelings that men have about the machines’; out of the primarily technical focus which most men had, and which had first drawn them to computing. It presupposed high levels of enthusiasm and confidence around technical issues and engendered the interchange of ideas and information which favoured an outspoken and sometimes even boisterous attitude to learning, which female developers felt unable to mirror. (p. 102)

Similarly, women tended to appreciate the rhetoric around the importance of teamwork in this workplace, although they found the practice of teamwork there problematic. While they usually followed gender stereotypes, working hard to establish a positive environment in team feedback and idea-generating sessions, they often reported feeling that their contributions were overlooked or interrupted by the male team members. They also remarked on their feeling of discomfort with the men’s preferred style of communicating and defending their ideas, which they experienced as aggressive and narrow-minded. Sometimes women perceived a process of exploitation by their employer and supervisors, based on the confluence of gender and skills. Some women described examples of how they were assigned tasks such as organizing divisional meetings and seminars. Initially, they saw this as recognition of their organization and coordination skills, but they also came to see it as a way for supervisors to devolve the non-technical tasks in a way that contradicted corporate rhetoric and reinforced gender disparity. Successful completion of these tasks was unrelated to rewards such as promotion, and actually seemed to diminish men’s appreciation for women’s technical skills which became obscured by a broad skill set and interests. In time, these extra responsibilities were resented even by women
who had initially welcomed the opportunity to incorporate their personally valued, non-technical skills into their work.

Woodfield (2000) refers to each of these examples of contrasting discourse, attitudes and practice as a “counterpoint” (p. 126). These counterpoints ran “parallel to the system of official doctrines and practices...[as] a series of informally generated alternatives which, taken together, constituted departures from the spirit of its most explicit cultural principles in significant ways” (Woodfield, pp. 125-126). It was largely in the context of these counterpoints that female and male employees constructed their workplace identities. The counterpoints acted to preserve technology’s association with masculinity and men’s traditional privilege in the workplace, while they penalized women for their wide-ranging skill base and approach to both technology and work. Not surprisingly, the men were more likely than the women to voice commitment to their current employer and to their careers in the IT field. For many women, the confusion over values expressed in rhetoric and practice inflated the general social problem of being a woman in a highly masculinized field. Others’ doubts about their technical capabilities compounded existing challenges to self-confidence. Not surprisingly, the women were less likely than the men to envision a long future for themselves in that workplace or the IT field. They typically described their technical abilities and work as “somehow always provisional” (Woodfield, p. 94), and most spoke about leaving the IT field for work that was either more overtly social or more likely to yield career progression opportunities. In these ways, corporate rhetoric, attitudes and practice contributed to gendered experiences, understandings and identities for the women and men in this workplace.

There is an important qualification to the research indicating gender differences, particularly in epistemological styles and learning or work strategies. Gender does operate in
knowing, learning and working, but this does not mean that all women follow feminized pathways and that all men follow masculinized pathways. As Panteli, Stack and Ramsay (2001) note,

“Our findings have also given partial support for views of differences in styles of working between men and women, but also considerable evidence that these tend to be stereotyped and overstated in ways that ignore differences among women (and by implication men too), and tend to reinforce ghettoization rather than leading to a true acknowledgement of the value of supposedly ‘feminine’ approaches. This is reinforced by what remains correctly identified as a strong masculine ideology in computing, which influences women as well as men in their perceptions of self and others. (p. 15)

A Critical Examination of the Rhetoric of the IT Field and the Knowledge-Based Society

Woodfield’s (2000) study brings the importance of rhetoric to the forefront of a discussion about women and technology. Educational and career decisions are always made in a social and cultural context which today includes rhetoric about IT and the new knowledge-based society. Although it is routinely presented as matter-of-fact, rhetoric is actually filled with assumptions and values. As Woodfield’s research makes clear, it is also often employed in a way that conceals the maintenance of traditional distinctions, barriers and privileges, and challenges the claim that the knowledge-based society is an altogether new thing. This rhetoric is part of the backdrop against which girls first encounter IT and women later choose their educational and career pathways.

“Soft Skills” and “Hard Skills”

Popular discourse distinguishes between the “soft skills” jobs that women are most likely to occupy in the IT field, and the “hard skills” jobs most likely to be held by men (Woodfield, 2000). Soft skills include the people-oriented skills of team work, negotiation and organization, and fit with women’s increased presence in IT jobs focused on communicating with and helping others. The image of these skills contrasts with those expected in the predominantly male-
occupied jobs of the programmers and engineers. Hard skills are exemplified by technical mastery and manipulation of the abstract.

Even within the programming niche, hard and soft approaches to work have been distinguished. Drawing on Turkle and Papert’s (1990) work, Panteli, Stack and Ramsay (2001) explain that “men are more likely to be comfortable with a ‘hard’ computing culture that emphasises mathematical calculation and working with source code, while women are more comfortable working through interfaces that permit a ‘soft’, flexible approach, allowing experimentation, non-sequential and non-hierarchical” (p. 12). The language of “hard” and “soft” skills is unmistakeable in its connection to masculinity and femininity, men and women. The assumption, then, is that men naturally excel at the work of programming and engineering, while women naturally excel at the work of technical communication and other people-oriented niches.

Beyond the IT field, some researchers note similarly gendered patterns in post-secondary and career decisions. In their Canadian research, McDill, Mills and Henderson (2000) provide a breakdown of participants in “enrichment minicourses” offered for high school students at post-secondary institutions in the Ottawa area. Overall, young women preferred courses in the arts and social sciences and were least likely to participate in an engineering course. Moreover, among the participants in engineering minicourses, young women’s first preference was the area of interior design and they were least likely to be found in the courses in systems or electrical engineering. Writing about the design field, Clegg and Mayfield (1999) outline a “stereotypical dualism whereby women are associated with the body and the decorative, and men with technology and the shaping of nature. The dichotomy of ‘hard’ and ‘soft’ is not unique to design, and there is a complex relationship between disciplinary cultures and gender” (p. 3).
Kirkup (2002) points out the irony in rhetoric “which suggests that new industries are both ‘gender blind’ …and that they value ‘feminine’ communication and ‘people’ skills” (p. 4), at the same time as it continues to emphasize the hard skills associated with the “high tech,” high paid, high status jobs in the IT field. The international research of Millar and Jagger (2001) confirms the presence of a proverbial “glass ceiling” which tends to keep women out of senior management positions, a conclusion reiterated by Panteli, Stack and Ramsay (2001) in their British research. Likewise, in her empirical research in the US, Woodfield (2000) finds that, contrary to the official discourse of meritocracy and “hybrid” skills\textsuperscript{12} in the corporate unit under study, men received greater recognition for their skills and were more likely to be promoted, despite their limitations in managing other staff and projects.

Although its focus is not on gender, Casey’s (1995) ethnographic study on the culture of work and worker identity in the knowledge-based society offers an interesting insight into the discussion of soft and hard skills or approaches. Her research site was a product development division at a large international corporation based in the American northeast. In her discussion of the pressures exerted by corporate culture on personal identity, she cites comments made during interviews with two participants. One participant, a woman, “reported that qualities she possesses in her style of work and interpersonal interactions are not recognized as contributive to team work and productivity. In particular, she felt that her low-key approach and intuitive ways of understanding people and processes were considered irrelevant” (Casey, p. 140). This is in

\textsuperscript{12}This is how Woodfield characterizes the unit’s insistence that soft skills are as important as technical skills to the success of its work, and that both types of skills were demanded of all employees working there. This is seen as a particular imperative in the unit under study, which is responsible for delivering consultancy services to other corporations as part of its research and development of new software products and applications.
contrast to the comments of a male participant with relatively little formal education who found that his “skills and ‘instincts’ were encouraged and rewarded. His lack of academic qualifications, in his case, were compensated for by his ability to take risks, act aggressively and make decisions” (Casey, p. 143). Here we have the word intuition summarizing feminized soft skills and approaches, and the word instinct summarizing masculinized hard skills and approaches. We also have an example of how official rhetoric conflicts with lived experience, as masculine hardness is rewarded regardless of formal education or workplace discourse and, potentially, regardless of both technical and so-called people skills and abilities.

“End Users” and Programmers

The types of jobs most typically held by women – the administrative or customer service positions mentioned by Millar and Jagger (2001), the help desk staff mentioned by Woodfield, the website designers mentioned in Habtu’s (2003) Canadian research, or the technical communicators studied by Selfe and Hawisher (2002) – are referred to as “end user” jobs. In popular rhetoric, it is the programmers and engineers who are recognized for their creative work of developing software and hardware, while the end users simply learn about and operate the technology provided to them. If the work of programmers and engineers is constructed as a matter of conceptual thinking and creativity, the work of the end users is constructed as a matter of developing technique.

This distinction between workers who are considered to be skilled, unskilled or semi-skilled is an interesting, and seemingly unique one in the IT field. Nobody describes the carpenter as an end user of the hammer, attributing the real skill in this example to the design of the tool rather than the execution of the trade. We do not obscure the creative contribution and often strategic importance of the work of other tradespeople and professionals who use materials
or concepts developed by others to do their work. The phrase “end user” does exactly that, by suggesting that website designers, technical writers, project managers and other technical communicators simply use the technology developed for them, in ways that are envisioned by the developers. In Selfe and Hawisher’s (2002) words, it recalls a simplistic, early understanding of “computers as calculating machines – not as writing or communication systems” (p. 261).

It is true that the design of hardware and software limits what technical communicators and other so-called end users can do and how they can do it. This is problematic for two reasons. First, if men are the primary developers of IT, then technology becomes a way to exacerbate rather than overcome gender (and other important) differences. As Margolis and Fisher (2002) explain, “If boys invent things and girls use things boys invent, a cyberspace culture will inevitably reflect the desires and sensibilities of males to the exclusion and often denigration of females” (p. 12). Secondly, the characterization of technical communicators as end users demonstrates how a rhetoric is shaping another layer of denigration within the IT field.

*Lifelong and Life-wide Learning, and Credentials*

One of the paradoxes in the discourse of the knowledge-based society is the simultaneous emphasis on the concepts of lifelong and life-wide learning, and credentials. Lifelong learning is the phrase applied to the understanding that, in the knowledge-based society, learning is an ongoing requirement and activity. Formal education can be a part of lifelong learning, as are a range of informal and nonformal educational settings and opportunities. Lifelong learning has been embraced in the fast-changing IT field, as people recognize the impossibility of accumulating sufficient knowledge in a formal educational program to last an entire career. Woodfield (2000), for example, makes repeated reference to the importance of ongoing training and learning in the corporation under study in her research, noting in particular the presence of
in-house instructors and educational programs. Nonetheless, statistics gathered by the Organization for Economic Cooperation and Development (OECD, 1998a in Millar & Jagger, 2001) confirm that employers are most likely to finance continuing education for employees who have formal credentials, undermining the value of skills and knowledge gained by other employees outside formal educational settings.

As a concept, lifelong learning can be problematic in its presentation of learning and career development as a linear, if also an enduring, process. Another phrase, “life-wide learning”, is also used to acknowledge the transfer of learning and knowledge across contexts and purposes. Despite the growing rhetoric of lifelong and life-wide learning, current or recent attempts to draw more women into the IT field are aimed largely at young women in high school or college, treating educational decision-making as a “one-shot” opportunity. Furthermore, an increased attention to formal credentials, illustrated by the development of new IT-related educational programs, undermines recognition of lifelong and life-wide learning.

“One of the changes brought about by IT is the promise of new, more flexible work arrangements. These include “telework,” or provisions to do at least some of a job from a home-based office, independent contracting, “flextime” work, part-time employment and job-sharing. Such arrangements have been touted as especially beneficial for women, as they appear to acknowledge and respond to women’s family, home and work responsibilities (Huws, 2000; Lipsett, 2000). These arrangements, the enthusiasts argue, create “win-win” scenarios for both employers and workers. Home-based work, the argument goes, decreases office rent costs for employers and decreases commuting costs (in time and money) for workers. Contract work saves
employers the cost of ongoing staffing and benefits, while it gives workers control over their work schedules and content.

Stanworth (2000) and Huws (2000) also outline some of the concerns held by people who are more sceptical about the knowledge-based society. These people offer a vision of work in which women become more isolated, their jobs and incomes become less secure, and their work is “deskilled” and devalued. There is the additional concern, according to Stanworth, that “Men may continue to defend areas of competence and succeed in occupying the more powerful organizational positions of the new age by excluding women, or abandoning occupational areas which begin to be colonized by women” (p. 21). Data show that “employers tend to invest less in the short-term and non-standard workforce” (Stanworth, p. 24), and there is evidence of “the persistence of informal male-dominated networks, homosociability and its effects on internal labour market decisions, as well as the exclusion of women from positions of direct organizational authority which are stepping-stones into senior management” (Stanworth, p. 24). Finally, to the extent that flexible work is held out as a strategy specifically for women to accommodate their family care demands, it reinforces traditional constructions of gender and undermines attempts to introduce other strategies designed to break down the barriers posed by gender socialization.

These possibilities and concerns extend to workers beyond the IT field, but can be realized because of technological developments. They are another reminder of the ambiguity of defining IT work and workers, and the role of IT in contemporary work life. Little, if any, research has been conducted on how IT workers in particular are experiencing the rhetoric of flexible work. Millar and Jagger (2001) do note that, in their interviews, “according to several interviewees the image of ITEC work – the long hours and the lack of alternatives to standard
working practices (part-time work and flexible work) – accurately reflects notions of professionalism that are integral to the culture” (p. 29).

That comment is echoed in other research in the IT field. As Woodfield (2000) summarizes this point, “Labouring within what has been called the ‘project mentality’, working long and non-standard hours under stress, and sidelining responsibilities to family and friends, has become the accepted *modus operandi*” (p. 19). In her research on work and worker identity in the new knowledge-based society and IT corporations, Casey (1995) describes a “designer culture” of work, which aims to both counter the alienation resulting from the breakdown of traditional occupational affiliations and build strong employee productivity and loyalty. Introducing the mixed analogies of workplace as “team,” suggesting the importance of competitiveness, and workplace as “family,” suggesting inescapable allegiance, this culture makes work-life balance an unlikely outcome.

In a particularly shocking example of the application of this type of culture, Microsoft tried to quash a court claim of a group of its employees. Woodfield cites one account of this story:

*The corporation lost its attempted challenge of the claim that it discriminated against some of its technical employees after it was successfully demonstrated that a manager had informed junior workers that marriage, and indeed any priorities other than work, were considered to represent a distinct disadvantage to both the company and their own career paths. The manager’s advice was to nurture a singles life-style which would fall in line with the organisation’s preference for those workers who “ate, breathed, slept, and drank Microsoft” and felt that it was “the best thing in the world”. (Cringley, 1993 in Woodfield, 2000, p. 18)*

In the IT field, where women are already under-represented particularly in the upper echelons, flexibility offers dubious promise for all workers, but especially for women.
Here in British Columbia, government has removed many IT workers from the protective coverage offered by provincial Employment Standards regulations. Businesses classed as “high technology companies” and workers classed as “high technology professionals” have been exempted from the regulations stipulating requirements for employee rights such as meal breaks, minimum daily pay and a minimum number of consecutive hours free from work each week (British Columbia Ministry of Skills Development and Labour, 2003). This topic arises in one of the interviews conducted for this study and, as Esther explains, it was “the BCTIA, the BC Technology Industry Association group that lobbied the government to remove the overtime restrictions and all that stuff for IT workers.” One could argue that exempting high technology workers from minimal employment standards is problematic for everybody in the field, not just women; however, this type of policy presents particular problems for women working in the field because of the continued presence of gender as a factor in their lives. In this instance, political policies and workplace practices serve to reinforce an already masculinized IT field, and add to the reasons for women to avoid IT education and work or, for those who have already started careers, to exit the field. There are surely exceptions among employers and governments that adopt more progressive, equalizing policies and practices; however, many of the dominant players in the IT field use rules which make the quest for gender parity look like a rigged game.

Complicating the Impact of Gender: Class, Race and Age

Despite the importance of gender as a line of social cleavage in society and in the IT field, gender alone does not determine women’s experiences and perspectives. Women and men are gendered, but they are also classed, racialized and aged. How gender, class, race, age and other affiliations are combined complicates access to privilege and opportunity for both women and
men. Gender never disappears as a variable, but it is always one of several variables in life’s equation.

In the context of her research with working class women and men, Olson explains that “the study of women needs to be the study of gender relations, which in turn are inextricably linked to the relations of class and race” (Olson & Shopes, 1991, p. 191). Her co-writer Shopes concurs with this view, noting that “as an explanatory framework for a life experience, gender functions not as a singular, unitary category, but as one inextricably bound to class and ethnicity” (Olson & Shopes, p. 193). As the discussion above implies, many of the researchers exploring the relationship between IT and gender devote little, or no, attention to other types of social divisions, including race and class. Some writers (e.g., Selfe & Hawisher, 2002; Huws, 2000; Stanworth, 2000) acknowledge that the financial cost of computer equipment and software implicates class in computer use, and computer science education and work. In a field where deep interest in and involvement with the subject is for many people expensive, financial inaccessibility to technology becomes an obvious issue. If computers and computing are gendered as masculine, they are also classed as wealthy.

Some writers have also brought race into their discussion of IT learning and work. As Stanworth (2000) explains,

_The information age is characterized by accelerating change and capitalist restructuring around emerging information and communications technologies. The path of change is socially changed around class, gender and race, and the outcomes cannot be neatly read-off as necessarily beneficial, uni-directional or gender-neutral._ (p. 29)

In their article focused on technical communication, Selfe and Hawisher (2002) centre part of their analysis on race, noting that, in the US, race and class continue to be tightly inter-woven. Likewise, they tie gender to class in their analysis, raising the increased likelihood that women,
especially single mothers, will experience poverty. While their analysis of gender remains largely restricted to its relationship to class, they do recognize several factors that complicate learning and work in the IT field, as they complicate other elements of life. They note comments from one study participant, a Black woman in her early thirties from a working class family, who exemplified some of the findings of American research into the developing computer market and uses. In particular, her experiences of growing up without a computer at home and in schools where computers were rarely integrated into curriculum recall statistics indicating that high-income children and youth have been more likely to use computers at school as well as at home. Identifying computer skills as increasingly important for many fields of work, that participant used options available in college to gain exposure to and skills with computers. As Selfe and Hawisher conclude,

"Although a complex of factors have affected technical communicators’ acquisition of digital literacy, race and class – and sometimes gender and age – can assume all too important a role in the lives of some individuals because these factors are linked with other social formations at numerous levels and because their effects were multiplied and magnified by these linkages." (p. 263)

This recognition of the importance of race and class in IT education and work is noteworthy; however, the restriction of gender as a characteristic linked to class represents a fairly shallow analysis of the links between gender, technology, learning and work.

Millar and Jagger (2001) and Selfe and Hawisher (2002) raise age as a fourth issue for women (and men) in the IT field. Citing findings from a recent survey research of people working in the British IT sector, Millar and Jagger note that "Ageism is rife in information technology despite severe skill shortages…A quarter...[of the respondents] said IT people became classified as ‘older workers’ at 40 and more than one in five sad that the defining age was 35” (Maitland, 2000 in Millar & Jagger, p. 29).
In Selfe and Hawisher’s (2002) research, age is evident in the experiences of educational and career opportunities available to and taken by technical communicators. They distinguish the experiences of technical communicators who entered post-secondary programs between the late 1960s and the early 1980s from those of technical communicators in the following 20 years. When they attended college, the oldest participants had few options available to them for IT-related education, especially if they were interested in IT work but not in programming or engineering. By the mid-1980s, new programs and courses had become available, increasing the educational options available for technical communicators. Nonetheless, computing studies continued to be dominated by an abstract approach to programming, what Selfe and Hawisher describe as “impoverished notions of electronic literacy” (p. 241). “Resourcefulness” is noted as an especially important quality for these technical communicators (Selfe & Hawisher, p. 241). For even younger participants, computers were more likely to have become a part of everyday life and study at an earlier age, making learning and use of computers seems more “natural” (Selfe & Hawisher, p. 242), and new educational programs had become available. Younger women in particular experienced the benefits of the marketing and socialization programs discussed above, which often encouraged and supported their participation in IT-related education.

In this way, age joins gender, race and class as a variable which influences the learning and work experiences of technical communicators and other IT workers. While their conclusions must be qualified by the small number of voluntary study participants and their analysis of gender remains somewhat superficial, Selfe and Hawisher’s (2002) work raises a number of important considerations related to gender and IT, particularly as they surface in the feminized niche of technical communication.
Summary

The literature summarized above confirms that, within and beyond Canada, women are under-represented in both IT-specific educational programs and work in the IT field. As IT has become increasingly popularized and present across life contexts, the IT field of education and work has been increasingly masculinized. Women who make their way into the IT field of work often do so with little or no formal education in IT-related subjects, relying on situated, lifelong and life-wide learning strategies, and at different points in their careers. Educators, researchers, policymakers and professional or women’s associations generally share a concern about women’s under-representation in IT-related educational programs and IT work; however, approaches to understanding and addressing this issue reflect differences in perspectives on the meaning of gender and its role in IT learning and work.

Conceptual work which politicizes gender as a factor in IT education and work recalls feminist theories about how epistemological choices and values in the sciences privilege men over women, and how they reinforce the masculinization of these disciplines and occupations. Turkle and Papert (1990) contrast the more feminine style of “bricolage” and interest in concrete applications of IT with men’s tendency towards a concentrated fascination with computers and a more abstract style of learning and problem-solving which is favoured in mainstream computing programs. This relatively early conceptualization of the role of gender in IT education has made an influential contribution to further research on gender and technology. Their research, along with that of Henwood (2000) and Margolis and Fisher (2002), explores the experiences of women who have studied computer science in either the US or the UK, and suggests innovative approaches to curriculum development and pedagogy which might support women’s participation in such programs.
Woodfield (2000) carries this research on gender and IT-specific education into the realm of work. Her study reiterates demographic research concluding that the “glass ceiling” is part of the experience of IT work even for women who do complete computer science degrees and enter the most high-status niches of programming or engineering, then seem to have their advancement stymied. Researchers such as Millar and Jagger (2001), Panteli, Stack and Ramsay (2001), and Habtu (2003) conclude that most women remain in lower-paid, lower-status niches in the IT field, also bumping up against what might be described as “glass walls” that continue to separate most of the men from most of the women.

One of the niches in the IT field where women have clustered is technical communication. The study conducted by Selfe and Hawisher (2002) provides a unique account of how American technical communicators have developed work-related knowledge and skills over the past 40 years. While their primary interest is in informing the development of formal education programs for technical communicators, they acknowledge the importance of independent, situated learning. Continual technological change means that no one person or group – including instructors – can answer all questions and that, even if they are provided, answers are always tentative.

Selfe and Hawisher’s (2002) research also provides an important commentary on the ways in which other factors, namely race, class and age, are implicated in IT education and career pathways for both women and men. Stanworth (2000) makes a similar point in her article. On the whole, though, these other factors are overlooked by researchers exploring the relationship between gender and IT.

There is a final, important cautionary note to this discussion: For the most part, the research reviewed above has been conducted in Western societies, namely Canada, the US and
the UK. While gender is undoubtedly a factor across other societies, the impact that it might have on determining learning and work pathways for both women and men internationally is complicated by the presence of other factors and their meanings. Gender and work, for example, intersect differently across societies, partly because of different industrial bases and priorities. Race, class, age and other important factors also operate differently at the same time as they continue to complicate the meaning of gender, learning and work. Perhaps these thoughts help explain a finding like Millar and Jagger’s (2001) of the startlingly high proportion of women present in Taiwan’s IT field. As I turn in the next two chapters to a discussion of the study undertaken as part of this research, I limit my exploration even further to the experiences and understandings of women learning and working in the technical communication niche of IT field in the Lower Mainland of British Columbia.
CHAPTER 3: METHODOLOGY

Methodological Overview and Analytical Framework

The study conducted as part of this research used a phenomenological methodology. Much of the previously conducted research summarized above, especially the feminist research (e.g., Turkle & Papert, 1990 or Woodfield, 2000), has also drawn on phenomenology. As Bentz and Shapiro (1998) describe,

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\text{the intent [of phenomenology] is to understand phenomena in their own terms – to provide a description of human experience as it is experienced by the person herself…. Ultimately, the researcher’s report would be of his own personal understanding of the phenomena of interest…. It shares with most other forms of inquiry the calling into question of so-called commonsense and taken-for-granted ways of describing and defining things. But phenomenology, more than any other form of inquiry, attempts to get behind the most elementary experiences of everyday life to look at their inner structure and how the mind makes them what they are. (pp. 96 & 97)}
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In this type of research, two things become especially important: the researcher’s own location in the context of the research questions (I have presented some thoughts on this in the introductory chapter), and the participants’ ability to reflect on and articulate their experiences. In this study, loosely structured interviews with open-ended questions allowed me to have conversations with participants about topics such as the meaning that IT, education and work have had in their lives, how they relate to the technology in their work, and how they create a sense of identity for themselves as women, as workers, and as women who work in the IT field.

A phenomenological methodology is appropriate in this study. Phenomenology seeks “to understand, to gain access to the meaning of human phenomena as expressed through an individual…. Phenomenological methods are not appropriate when one is trying to establish the pervasiveness of an attitude or behaviour or to compare situations in order to predict or control” (Bentz & Shapiro, 1998, p. 98). As the published research summarized above indicates, little is
known about the experiences of women who work in the non-programming niches of the IT field. What can the meaning that they attach to technology and to their experiences with it contribute to the body of literature exploring women and IT?

Finally, Bentz and Shapiro (1998) say that, for phenomenologists, meaning is constructed,

both in internal conscious and unconscious processes and in interpersonal exchanges through which the meaning is made social. Phenomenology does not explain, but rather it creates understanding among the set of observers and observed. In this sense, it is not a research procedure but a means of cocreation that makes public and manageable the lived experience. (p. 100)

The interview process in this study provided an opportunity for meaning to be articulated and heard, and for understanding to be constructed and relayed. As a researcher, how have I been able to convey an understanding of women in IT, particularly in the technical communication niche, which reflects input from participants about their experiences and understandings, and the history and understandings that I brought to this study?

Phenomenology has provided a way for me and the larger study team to address these questions; however, I needed an analytical framework that I could use to make sense of data from the subset of interviews used here. Feminist standpoint theory gave me a way to analyse the content of interviews, given the focus of this study on women’s experience. A series of articles published in the journal *Signs* articulates contemporary opinions on feminist standpoint theory, including the recognition that gender is not a homogeneous category, and clarifies its helpfulness in understanding how group power dynamics are played out in daily life and come to embody knowledge(s). As Harding (1997) explains, “standpoint theorists use the ‘naturally occurring’ relations of class, gender, race, or imperialism in the world around us to observe how different ‘locations’ in such relations tend to generate distinctive accounts of nature and social relations.
(They do not determine them, but only ‘tend to generate’ accounts different from the dominant ones in distinctive ways.)” (p. 384). How gender continues to operate as a point of social cleavage, how work and learning are named and rewarded within the IT field, how technology is conceptualized and developed, how opportunities for and barriers to girls’ interaction with IT – these help explain how women understand, relate to, learn about and work with technology.

As other standpoint theorists reiterate, gender is a more complicated grouping than race or class. According to Collins (1997), “gender raises different issues, for women are distributed across these other groups. In contrast to standpoints that must learn to accommodate differences within, feminist standpoints must be constructed across differences such as these. Thus, gender represents a distinctly different intellectual and political project within standpoint theory” (p. 378).

We can expect that different women will talk about technology and their IT learning and work. An important part of the explanation behind this is tied up in women’s memberships in groups other than gender, which either accord or deny them opportunity, choice and power in the classroom, in the workplace and, more generally, in life. Membership in other oppressed groups does not, however, eliminate the impact that gender has long had, in some way or another, on all women’s work history. During the interviews for this study, one participant initially voiced the opinion that, because it is such a new field of work, IT has no systems for discrimination in hiring and knows no prejudice. “I don’t believe there are any traditional barriers to women accessing any of the career paths in the IT industry. They could easily be president of companies,” Elaine explained. A few minutes later in our conversation, she began to qualify this view:
Elaine: I am so blessed because my current boss who I love working for is a woman. My boss before that was a woman. So I’m used to…. I hardly think about that aspect but certainly if you were to talk to my boss, she would have a very different outlook to me, maybe a generation thing. Could be a generation thing. She grew up probably in a predominantly business world that was ruled by white men. And her struggles to get to where she is…. She, I’m sure she would say there were barriers for her. But because I’ve had her on my team, I honestly haven’t felt like there’s been any barriers for me and I don’t talk to women who…say there are. Although I’m sure there are. Right, I mean I’m sure that stats say there are.

Kaela: Are there any aspects of IT jobs that you can think of that would not be good for women?

Elaine: No.

Kaela: Okay. Do you see lots of women in the…?

Elaine: I do…. Our office is 60 per cent women. However, when I go to…. Well, one thing I was just thinking of this week…. When I was reading in the Business in Vancouver, all of the top 50 fastest growing companies, all men except for one. So there’s something to that. There’s something to that for sure.

Elaine is a woman who, because of other factors and group memberships, has had opportunities extended, more often than squashed, in her life. A feminist standpoint perspective erases neither her individuality nor the presence of a gender divide throughout history and across society, but it does maintain a focus on the political nature of that gender divide. As Huws (2000) outlines, women tend to have less disposable income and leisure time, and fewer technical or scientific credentials than men, and are more likely to be employed in part-time, low-paid, low-status jobs, or jobs in the “informal” sector. This is the general pattern which is evident despite individual differences, and is reflected in the developing IT field. As Huws explains, talking about the impact of gender in the knowledge-based society, 13

13 This refers to the invisible work carried out, often in other people’s homes, by domestic workers, cleaners and other service providers.
“Men” and “women” cannot be seen as homogenous categories but must be studied in their specific situations, where occupational and regional variables play a major role. Nevertheless, it is already possible to see that the new forms of work emerging from the introduction of ICTs exhibit strongly gendered patterns, which not only reproduce existing patterns of segregation but in some cases add new dimensions to them. (p. 345)

Within the phenomenological methodology of this study, feminist standpoint theory provides a framework for exploring the questions of how technology, education and work are gendered constructs, and why women tend to follow particular learning and IT career pathways.

**Methods and Tools**

Semi-structured interviews used in this paper were conducted in the fall of 2003, using the interview schedule developed by Dr. Butterwick in consultation with other project staff. Topics in the schedule include background and demographic information; IT learning and work history; perspectives about jobs in the IT field; rewards and recognition of participants’ IT skills; and advice or suggestions for the researchers. The schedule in use for the interviews used for this study, as well as the background information letter sent to prospective participants and the letter of consent completed by all participants, are attached in the Appendices.

A copy of the interview schedule was provided to participants prior to their interviews so that they could consider the important issues in their learning and work, and how they would like to articulate them. In keeping with feminist research methods, questions were open-ended and interviews were conducted as conversations. The schedule was used as a guide for these conversations, and all interviews closed with a series of questions about other topics that might be important to the participants but were omitted from the schedule. Participants’ responses to those questions and their input throughout the interview led to occasional revisions of the interview schedule. With the consent of participants, interviews were tape recorded and later
transcribed. Participants had the option of reviewing their audio cassettes, the transcript or both, and forwarding questions or clarifications before their interviews were finalized. Pseudonyms have been provided for all participants, and references to any other individuals or companies identified during interviews have either been removed or been similarly masked.

**Participant Recruitment and Selection**

The larger study from which I selected five interviews is still underway at this time. While I was conducting my research, we relied largely on our own networks and acquaintances, and word-of-mouth promotion from participants to their acquaintances as recruitment strategies. A one-page promotional flyer was developed and distributed to several IT training colleges and local IT companies. We also shared the flyer with participants and asked them to distribute it through their own networks.

We have used a broad definition of who is an IT worker, recognizing that this is a new field which is continuing to develop and define itself. Technology has a definite but still undetermined impact on many jobs and workers. Rather than impose a strict set of criteria to screen potential participants out of this study, we have maintained an openness which allowed a range of potential participants to self-select into the study. Participants’ work has had to include knowledge and use of IT skills beyond keyboarding and basic software use, and has extended to a range of niches and occupations in the IT field. These include computer programming, software development, network administration, project or operations management, database development and, of course, the technical communication areas of website development, strategic online communications, technical writing and training. We also broadened the understanding of work to include both paid employment and volunteer work. With all
participants, including those who have completed formal education in an IT-related program, we are most interested in hearing about alternative learning pathways that they have taken into the IT field.

The analysis contained in the remainder of this paper is framed by the literature review presented above and based on a selection of five of the interviews conducted for the study. These interviews, all of which I conducted, were chosen because the participants work or have trained in the area of technical communication. Their current or recent work has involved them with a range of technical communication jobs and responsibilities: website design and maintenance, strategic communications, marketing and account management, project management, curriculum development and training, and technical writing.

Consistent with the comprehensive understanding of IT work and technical communication used throughout this paper, these participants spoke of having a range of educational backgrounds and current jobs. Participants ranged in age, with four in their mid to late twenties and one in her late thirties. While some spoke more openly about their privilege, they could all be described as coming from middle class, well educated, professional families. Four of the five participants reported being single, and the fifth was recently married. All but one Asian participant were White and Canadian-born, and one identified her religious or cultural background as Jewish. Four of the five participants had completed an undergraduate degree in arts (one after having transferred from a science major), and the fifth had completed two years of

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14 During one of the interviews, the microphone on the tape recorder malfunctioned. As a result, much of that recording was of very poor quality, and parts were inaudible. As much of the interview as possible was transcribed, although there are gaps in the transcript. During all interviews, I also took written notes, which proved helpful in supplementing the transcript and recounting this particular conversation. The participant also reviewed the typed transcript and filled in some of its gaps.
undergraduate studies in arts before switching to a community college to complete a certificate program in graphic design. Undergraduate majors included European studies, psychology, communications and environmental science. One of the participants had further completed a certificate in internet publishing, after some earlier courses at a technical institute in desktop publishing. While one of the five participants worked in a large public institution, the other four provided technical communication services working either as self-employed contractors or in small companies. Two of these participants worked exclusively with non-profit organizations, one of them worked with both other small companies and non-profit organizations, and the other participant provided services predominantly to corporate clients.

Recounting My Analytical Process

Because I conducted the five interviews used in this study and transcribed three of them, I connected quickly and intimately to their content. Even if I had not transcribed the interviews myself, I listened to the audio recordings and compared them to the typed transcripts. Listening to all five audio recordings helped me note participants’ emphasis and tone, and was a first analytical step.

My analysis was further guided by the interview schedule which outlined the topics to be covered in all interviews. The structure of the schedule provided a general guide to conducting interviews and then, during analysis, examining the data in manageable, topic-specific chunks. Any additional questions in this study-within-a-study were incorporated into the interview conversations. Trying to keep these questions at the foreground of my analysis, I copied them and taped them to the wall above my computer for quick reference and re-refocusing as I worked.
Sometimes, a participant used especially strong or notable language to describe a particular aspect of her experiences and understandings; in my review of the transcripts, such words or phrases became points of comparison and contrast to the comments made by other participants. As I listened to the audio recordings and reviewed the transcripts, I noted these comments as they related to my original questions and began to sketch an analysis as thematic answers became more visible. Chapter four contains the picture that materialized throughout this process.

**Limitations/Delimitations**

With its admittedly small number of participants, the research summarized in this paper seeks to broaden the discussion of women in the IT field by focusing on a niche which has been gendered as feminine but under-studied even by researchers interested in gender and technology. Drawing on in-depth interviews, it has created an opportunity for women within the technical communication niche to begin articulating their own experiences and understandings. Like all qualitative research involving few participants, the findings of this study are not being presented as generalizable to all women working in Canada’s IT field, or even to other women in the Lower Mainland area. For me, this research has connected to and enlivened findings and conclusions in the published research already discussed in chapter two, at the same time as it has raised new thoughts and questions about feminized niches which have remained largely overlooked in the literature. The analysis which follows moves beyond the conceptual and demographic research into gender and IT technology previously discussed in chapter two, and gives voice to women about their learning and work in one of the niches gendered as feminine within a masculine IT field.
CHAPTER 4: 
EMERGENT THEMES AND ANALYSIS

A number of coherent themes have emerged from this small sample of interviews. Often, they reflect the literature summarized earlier in this paper. At the same time, we have to remember that many technical communicators are not counted officially as IT workers and have been excluded from much of the published literature. In the course of this research, I spoke to some people whose initial response was to exclude technical communicators from their definition of IT workers, because technical communicators are always so-called “end users” rather than programmers or engineers. The participants in this study, all of whom worked or studied in the technical communication niche, had a variety of IT-related tasks and responsibilities in their jobs. These include website design and strategic online communications, technical writing, and training and support. Additionally, their work involved tasks and responsibilities indirectly related to IT, including team coordination, customer relations and account management, and marketing and business development. This research, even with its few participants, pushes the boundaries of the IT field outward by extending the discussion of how work in the IT field gets done and by whom, illustrating the interplay between gender and IT learning, skills, knowledge and work, and presents a glimpse of how and why technical communication is developing as a gendered niche for women in the IT field.

In my analysis, I have found six main themes reiterated throughout these interviews. Although individuals often said different things, these themes remained salient to all five participants. These six themes are understanding and relating to technology as a tool; carving indirect learning and work pathways into the IT field; coping with being a woman in a masculinized field; relying on situated learning and intuition; creating professional identities; and
using passion to guide educational and career decisions. Each of these themes is discussed separately below.

“It’s Just a Tool”

Relating to Technology

One of the striking things about these five interviews is the frequency and ease with which these women voiced an understanding of the computer as “just a tool.” Their aims and interests might be different, but these participants spoke about IT as a way for them and their clients to accomplish objectives, rather than as objects to be mastered. They typically reported having enjoyed using computers from their first exposure to them, of having felt comfortable with them, and of recognizing the convenience and possibilities that they offer as a tool. This has made IT useful and interesting. Melanie gave a particularly clear explanation of her understanding of technology, and its role in her work:

Kaela:  So, although you enjoyed working with computers and technology, you weren’t, I’ll use the word captivated by it?

Melanie:  No, I wasn’t. I was more interested in humans than anything technical. And that’s always been my driving interest.

Kaela:  Okay, okay. And the computers were a way…?

Melanie:  They were just a means to an end. This is the thing that I find, it’s…it gets lost. Computers are just a tool. They’re a tool that people have fancified into, you know, mystical things. And, it’s just a tool.... And, I think programmers have a vested interest in propagating the myths. The myths that are out there. I find the people who most believe that are the public and, I guess, programmers.

15 All participant names are pseudonyms, provided to protect participants’ privacy and maintain standards confidentiality.
Over the years, the computer’s usefulness has become more apparent to participants, both at work and outside of work. They became and remain interested in technology because it is useful, rather than an object of fascination in itself. In this way, they resemble the female participants of research conducted by Margolis and Fisher (2002), Henwood (2000), Woodfield (2000) and Turkle and Papert (1990). Even Elaine, one of the participants who was most enthusiastic about the IT field, related to technology as a way to get things done more easily, neatly, quickly and effectively. She spoke of using her home computer and the internet for learning and hobbies, on her own and with friends, but always in a way that linked IT to other interests:

Elaine: I have a weird thing. I like to do business plans.

Kaela: Okay, so you’ll help friends who are launching a business or something?

Elaine: Yeah, I’ll help them or if I’ve got an idea of my own I’ll map it out on a business plan, like on the weekends or the evenings…. We take a lot of digital photos so we…organize our photos, and….

Kaela: So there are sort of leisure activities that….

Elaine: And I’m a huge web surfer and we’re constantly on the net looking at real estate in Vancouver or checking out concerts or….

Kaela: So that’s how you learn, all kinds of things, not just about IT but, just, you learn what’s up and what’s out there and what’s happening through the web.

Elaine: Definitely….And I also love to sing and play guitar and, you know,...[we can] record it and put it on the computer with some digitized stuff. You know, just the nerdy hobbies.

Other participants talked about the usefulness of IT, the importance of IT skills, and their attraction to and use of technical communication for a variety of other reasons, both in their work and personal lives. Like Elaine, Esther and Susan welcomed the opportunity provided by this niche to exercise creativity in design and to develop new strategies. Andrea and Melanie
identified the potential to use their IT skills to help non-profit organizations and their clients build capacity and press for a more civil society.

The Social Context of IT Work

If IT is just a tool in their work, what do these women see as the parts of their work that have the most value and meaning? All of them mentioned the importance that working with other people holds in their learning and work, and the importance of good communication and “people” skills. Their interests and backgrounds are varied, but these women share an attraction to IT, specifically the technical communication niche, for the way in which it brings them into contact with other people. These others might be colleagues, mentors or clients, but they counter the solitude of work at the computer and were always mentioned when participants were asked about their most rewarding experiences in the IT field or in their own learning. One participant, Susan, remembered a group project that she worked on in her internet publishing program as particularly rewarding in her learning process:

Susan: When we had to work in a group for our project. We had differences because in our group we had three fairly design-oriented people. Ideally, it was one designer, one programmer and one project manager. And two were worker bees. But we had three really strong designers...

Kaela: So part of what appealed to you about that was...

Susan: The group work.

Three other participants, Esther, Melanie and Elaine, spoke about the importance of mentors in their learning, and recalled the opportunity to learn and work alongside particularly supportive, more senior colleagues or bosses who had served as mentors to them. For the five participants in this study, working with IT was enjoyable, but primarily so when they found a way to use the technology to learn and work alongside other people.
Communication skills were also repeatedly mentioned as key by the five participants. In Melanie’s words, the technical communication niche is all about communication, as it bridges people with different skills, priorities and needs. In her words,

_Melanie:_ See, what happens in the software world is often there’s a big gap between development of programs and end users. You get these programmers who have these, you know, these program-centric, very technical-centric ideas of how they think the programs should be used, which really subtracts right out of the equation how actual people work. How their minds work and how they approach software to begin with....

_Kaela:_ So were you like a bridge? Between the real tech people and the end users?

_Melanie:_ Well, yes. And in fact, the whole domain of technical communications is a bridge. That’s what it is. That’s exactly what it is. Or, I should say, it encompasses that. And it can extend to being, you know, a substantial part of the development team. It could be.... You could become an analyst, you know. If you have, if you’re more technically inclined. In the domain of technical communications, you can become a technical analyst because you really understand the needs of people. You write the programs as well as you have to speak the language of technology so you can talk to the programmers on the other side....

This excerpt summarizes an essential function of technical communication. As a niche, technical communication holds jobs which allow for diversity of interests, skills, abilities and educational backgrounds. Within this niche, IT is both a tool that participants use to shape their expression of these qualities, and a medium through which these qualities are made manifest.

**The Long and Winding Road**

A second point of similarity for these participants, despite their individual differences, is the meandering path that has led them into and, in one case, away from the IT field. Interestingly, all of these participants started their education in the arts. Only one had a formal IT-related credential and even her earliest interest was in desktop publishing rather than technical communication. While some of the others have completed short IT courses or workshops in
topics such as HTML or software packages, their route into the IT field has been indirect. Consistent with Canadian and international research on women in the IT field, these participants illustrate women’s continued tendency to study in arts programs at the post-secondary level and the tendency of women who enter the IT field to do so in spite of, not because of, their post-secondary education.

The Accidental IT Worker

If they did not choose IT-related educational programs, how did they come to work in the IT field in general and technical communication in particular? Two of these women came to the IT field with at least some post-secondary education in desktop publishing or graphic design; however, with the popularity of online publishing since the late 1990s, they quickly came to understand the growing importance of IT skills, the enhanced opportunity in the IT field, and the transferability of their design skills into the technical communication niche in particular. One of them went on to complete an online publishing program. A third participant, Elaine, also had experience in the print publishing field, as well as a job in an IT project aimed at promoting the field to girls prior to starting her current work. She saw the potential to transfer her knowledge into a specific company and job that seemed exciting to her. Towards the end of her interview, Elaine emphasized how she was interested in that job, but still felt that “one thing that I didn’t reiterate enough was that I totally fell into this career. I hadn’t planned to be in it.”

Another participant began her career as a technical translator with an interest in the publishing field; that experience was her entrée into the field of technical communication which, for her, has involved technical writing, project management, curriculum development and training. For the most part, these women started off on an educational path that seemed to be taking them in a direction unrelated to IT and technical communication but, for a variety of
reasons, they chose to shift their careers toward technical communication. Esther’s account of how she came to the IT field and technical communication exemplifies the accidental IT worker:

And I went travelling, came back and needed money, and was waitressing, and basically ran into a woman who I went, took classes with. And she was leaving a job as an Office Manager and Communications Director for a small start-up software development company in Vancouver. And in ’98 in Vancouver, there were tons of jobs in technology floating around. And her job was financed by the, by Industry Canada as a grant for new grads, specifically favouring women from communications and computing science programs and...I was sort of able to make my degree...look like it qualified. And she was leaving this job because she wanted to move on and they needed, in order to continue to fill this position, they needed this grant to pay the wage.... And so I fulfilled those requirements. I went and interviewed and got the job. And that was my first job in IT.

Planned or purely accidental, the educational and career routes taken by these women wound through a variety of interests and skill areas. As the research summarized above indicates, women’s participation in post-secondary education has increased in recent decades; however, women in university still tend to select majors in the arts rather than sciences, and relatively few complete IT-related educational programs. While these factors might make it difficult for women to enter the field in niches such as programming or engineering, technical communication, a niche which draws on a range of skills, abilities and interests, has become a plausible choice for the women in this study. The limited Canadian statistics available on the technical communication niche, such as those summarized by Habtu (2003), indicate that women in the IT field are attracted to this work, especially website design. The relationship between technical communication and other types of work, and the transferability of skills from an arts-based education to the technical communication niche, suggests at least some of the reasons why this is so. In Melanie’s summary, “the field of technical communications is definitely, there’s a lot of women in it.... It’s about communications, it’s about bridging gaps. It’s about translating between things that women are very good at doing.”
Timing and Networking

Timing emerged as another important issue in helping to carve participants’ career paths. Four of the five women entered the IT field before the year 2001, when Bowlby and Langlois (2002) establish that the ITC “bust” was underway. They described the ease with which they entered the field and the technical communication niche. Esther was succinct in her account of entering the IT field in 1998, when “in Vancouver, there were tons of jobs in technology floating around.”

Only one participant, Susan, first tried to enter the IT field after 2001. Ironically, she was the only participant who also completed IT-specific education, having received an internet publishing certificate. This is how she summarized her entry into IT education and work:

> Well, I’ve always wanted to do publishing…. When I was in high school in grade 12, I just fell in love with publishing, desktop publishing. I was into yearbooks, I was into designing, publishing the annual, sort of, brochures and stuff. So that’s really, that’s what I thought I was going to do for the rest of my life, back then. So I started taking part-time publishing courses…right after high school for about a year, intermittently. Like, a course here and there. So I didn’t really enrol in a formalized program, I just started taking courses and I found I really liked it. And I got a part-time job while…[at university] doing administrative stuff…. The job had publishing components as well, so I had to design annual reports, I had to design advertisements, I had to design brochures. So that kind of got the ball rolling. And of course there’s this internet growth. So I thought, okay, that’s kind of where it is. So I kind of went from desktop publishing to internet publishing. So I don’t think it was a conscious decision on my part to sit down and jot down my life goals and say, okay, next year I will do this. It’s a really subconscious, continual thing for me to move from desktop publishing to internet publishing.

By the time she had graduated and began looking for work, it was 2002. As she explained,

> So it was a matter of lack of experience and totally saturated market and I just didn’t really know, and I didn’t really have anybody to turn to because I didn’t really have a very wide network of people I could ask for help. So I think…So it wasn’t a lack of interest or anything and it wasn’t a lack of expertise, I wouldn’t say…. I did get work, but just not as much as I would like to sustain myself.
For now, she is working in a secretarial position which, given the increased presence of IT in everybody’s work, makes use of her skills without giving her the satisfaction of being fully engaged in IT work, particularly her favoured part of the technical communication niche. Susan’s path has taken her towards and, temporarily she hopes, away from the IT field. Because technical communication skills are so broad and so transferable, this is a turn that she has been able to negotiate.

**The Importance of Intuition and Situated Learning**

*Styles of Learning and Problem-solving*

Regardless of their educational backgrounds, these five women have shared a clear reliance on situated learning as a strategy to gain IT knowledge and skills. By “situated learning” I refer to an understanding of the learning process as one anchored in concrete reality, rather than in formulas and text books. Formal education can become part of this learning process as information and resources are brought out of the confines of the classroom and into other settings where problems demand resolutions that are actually, rather than theoretically, viable and reasonable.

Reminiscent of participants in Selfe and Hawisher’s (2002) study, Esther and Elaine both used the word “resourceful” to describe themselves and their ability to learn on-the-job. Although Selfe and Hawisher attach this word particularly to older technical communicators, it might well continue to resonate among younger women in the field. It is an indication of the importance of situated learning in this niche.

One of the reasons that situated or experiential learning is so important for technical communicators and many IT workers is that the pace of change in the IT field is so rapid. New
types and versions of software appear regularly, and technical communicators must be able to incorporate these differences in their knowledge base, as they move from one software version to another or from one workplace to another. As Melanie explained,

*I mean, one of the things about software is they keep versioning things, you know, coming out with new versions. Usually, often, it’s just bug fixes. They didn’t do something right the first time, so they’ve got to get it a bit more right.... But it gets kind of annoying.... And the thing is, there are so many kinds of tools that do the same thing.... And, one company will choose this, that and the other thing for certain reasons, and the next company will choose different ones for another reason. So, you know, you have to learn different ones.*

While some of the participants expressed frustration with the pace of change in the IT field, most shared a love of learning and enthusiasm for rising to this challenge. Andrea and Melanie also expressed frustration over continual software and hardware changes and the learning requirements associated with them. “*It was sometimes a bit discouraging,*” Melanie explained. “*It did sometimes feel like...I just finished learning that and now they’re coming out with this thing.*” These two participants discussed this phenomenon with a cynicism directed towards the IT development sector. For Andrea, “*I honestly don’t think that Microsoft comes up with brand new versions to help people or to help them access things. I think they’re doing it for money.... I mean, it’s great that new versions of stuff help us do more things but there’s got to be a happy medium in there somewhere.*”

Regardless of their feelings about having to constantly evaluate and upgrade their software or hardware knowledge and needs, participants described a strong reliance on situated or experiential learning in the course of their IT work. On the topic of building technical skills and knowledge, Melanie described how she “*picked it up more by osmosis than anything. And definitely on the job I picked up a lot, on the job. No question.*” Esther revealed a unique reason why technical communicators, especially website designers, can pick up information, knowledge
and skills through experience. Compared to the area of software development with its proprietary concerns and carefully guarded programming and engineering processes, the internet holds few secrets. The internet is,

> essentially open-source and you can view the source on any webpage. So, but I mean back in the days, this was a lot easier because people used much more simple technologies but if you saw something cool on a page you could view the source on it and literally copy the code and then puzzle it through on your own and figure out how you could replicate it.

At times, participants relayed a more overtly social approach to their situated learning, drawing on more experienced colleagues and supervisors. Elaine described her tactics, and how her current workplace has facilitated those tactics: “Reading, my colleagues, our office is extremely open. We have no cubicles, no barriers. We have...weekly meetings where we talk about stuff and we're all sort of on the same page. They're very open minded people and I'm not afraid to ask people questions either.” Esther and Melanie spoke of a more intense mentoring relationship as a valued support to their learning. Interestingly, only Esther and Elaine mentioned participation in IT and business networks, including Wired Women and the Vancouver Board of Trade, as important learning supports.

Beyond technical skill and knowledge requirements, niches like technical communication require various non-technical skills, including communication, interpersonal, organization and time management abilities. The breadth of skills and knowledge, and the pace of technical change encompassed in the work of many technical communicators, including the participants in this study, illustrate why formal education can never be the sole learning pathway in this niche. Participants in this study shared an understanding that what might be referred to as situated, experiential or tacit learning was crucial to their success at work. While this need exists in other
fields, the pace of change in the IT field amplifies it for IT workers, including technical communicators.

Participants used different words to express this reality of their work, but the sentiment remained the same. Turkle and Papert’s (1990) use of the term “bricolage” represents a learning strategy based on learning from concrete experiences and everyday life. The extent to which bricolage is adopted as a strategy throughout the technical communication niche, and whether or not it remains a strategy more likely to be adopted by female, rather than male, technical communicators cannot be discerned in this study; however, its presence and importance in the learning and problem-solving processes of these participants is unmistakeable.

Bricolage is an academic term and, predictably, not the word that participants used to describe their learning. Early participants in the larger study favoured the word “intuition”, so much so that questions about intuition were inserted into a revised interview schedule in October 2003. Although intuition is not always the same as bricolage and each participant offered a somewhat unique understanding of the word intuition, they all referred in some way to tacit, situated learning. For Melanie, intuition is “a pre-verbal instinct that you somehow have to articulate to yourself.” Similarly, Esther articulated an understanding of intuition is “gut feeling” which she brings primarily to her client relations work rather than to her resolution of technical problems. Andrea, on the other hand, thought that problem-solving is an area to which she would bring an intuitive approach:

Kaela: Would you say...Do you think that intuition plays a role in your learning and problem-solving?

Andrea: That was a funny question actually when I read it. I thought, oh, let me think about that. I think it does in problem-solving, definitely. Like I don’t think I would go into a project saying that I use a whole lot of intuition to make
Susan also spoke of her use of intuition in problem-solving. In her mind,

*Intuition for me is really more experience.... I think intuition is...it’s something that you feel is right based on what you’ve done before when you have encountered similar problems, without really thinking about it. That to me is intuition. However, I think that difference between intuition and experience is that you actually consciously recall it the specific steps you went through to solve a previous, similar problem. Whereas intuition just comes naturally, without you making a conscious effort.*

Finally, Elaine combined some of these thoughts. She characterized herself as intuitive because,

*Like, if I can do something once, that I do...myself, I get it and then I can refine my process. But you can’t just tell me, this is what you do, this is what you do.... And I need to actually have my hands on it and work at my brain, to wrap my brain around it. But I also have pretty good hunches about stuff, too.*

These understandings of intuition occasionally go beyond the concept of bricolage, at the same time as they confirm the influence of bricolage on participants’ learning and problem-solving. They resemble both Turkle and Papert’s (1990) description of bricolage among female computer programmers, and Orr’s (1996) description of the triangular relationship created between technicians, computers and customers. A variety of tactics, beyond relevant understandings of intuition, comprised participants’ bricolage. In addition to short courses, workshops and seminars which all participants used as one form of learning, they mentioned colleagues or mentors, books, online tutorials, manuals and, to a lesser extent, periodicals as sources of technical information. They also discussed the importance of “*playing on the computer*” as a way to consolidate, test and come to understand technical information and learn new programs or functions. Even Susan, the one participant with a formal IT-related credential, reiterated the importance of using bricolage and intuition as a way to cope with the infinite number and variations of problems that might be encountered at work:
I don’t think it’s very usual that an exact problem repeats itself. Most likely only a small part of the new problem is the same as a previous problem that you’ve managed to solve, but the bigger part of the new problem may be something entirely new…. And I think it’s a logical way of solving a problem, solving any problem in fact, because when a problem comes up…. Well, the way I see it, is….in approaching problems, I have this wealth of experience. Why not go to that first before I just go heading into this new problem and try to solve this problem from scratch? I mean I have this knowledge that I’ve used before. It’s almost like for new problems you go to see if you’ve got any solutions.

Recognizing Skills and Knowledge

While all participants acknowledged their application of intuition, there was some admission that the use of intuitive learning and problem-solving was guarded. In the following exchange about incorporating intuition into work, Melanie explained her sense that caution was necessary:

Kaela: Do you think that’s how people commonly work in the IT field? Is that something you’d sort of keep to yourself in the IT field?

Melanie: Well, you know, that’s a really good question. Because, one thing I learned is you definitely have to choose the people you’re telling certain things to really carefully. In the IT field, if it’s too far afield from what people working in the IT field can understand and relate to, they’ll just put an X in their minds, in the black voids of their minds, they’ll just X it out. And, um, and they’ll just have these kinds of reactions, you know. Disbelief or mockery or, you know, various reactions of those kinds.

Melanie’s thoughts are reminiscent of the comments made by some of the participants in Turkle and Papert’s (1990) study, and the references to teasing or harassment in Henwood’s (2000) and Margolis and Fisher’s (2002) research. Women’s explanations of having to alter their ways of working with computers and have having to fake acceptance of the formally acceptable style hint at Melanie’s understanding that certain stylistic preferences are best kept to oneself in the IT field. Although they are somewhat removed from the abstraction more typical in the programming niche, technical communicators might still be subject to the expectation that IT work is conducted in a formalized, systematic way.
Sometimes, participants seemed to qualify the value of their own styles and strategies of learning and problem-solving. One participant, Esther, mentioned that although she had no IT-related credential or education, if she were starting out in the field again today, she would participate in some sort of formal program. Talking about the experiences of herself and colleagues, she attributed her lack of IT education to timing:

**Esther:** And again, that’s been just being a product of the right time. I mean...[I was] there, involved in the web when it was sort of, I mean not starting out, starting out, but really hitting the mainstream. And in those days, you couldn’t really design on the web, it was pretty hideous. And so when the first designs started being developed we were sort of part of the people who were doing that. And honestly there weren’t many courses for people that explained the web. Most design courses you could take were in print design and print design does not really translate to the medium really well. There are basic principles of design that translate, but print lay-out is completely different. Print is a static medium, the web is an interactive medium. So it’s more about interactivity design, which is something I think you get more from experience than you do from formal training.... We did have a bit of a complex about not having formal design training which is why we’ve taken courses.... Then the rest of our training, training in the technical side of things is actually hard to get because we’re from this generation that knows a lot but not quite everything. And there’s not a lot of courses offered sort of...there are very few courses offered...for people...at the sort of level we’re at and want to learn more, because most of those people...are basically self-taught...and so they’re not used to going out and looking for courses. They’re used to figuring it out themselves.... I think that will start to change.

**Kaela:** You think that will start to change. Why?... Because it seems to me that what you’re describing is a, a sort of an occupation or a field of work or a sub-field within the field of IT where people are drawn because they can be creative, they can exercise initiative, they can be resourceful, they can learn on their own, they can experiment. So it attracts a kind of person who is not necessarily going to be drawn to the route of formal...

**Esther:** Yeah, well, but people are coming at it now through formal coursework increasingly.... And people are learning to program for the web through formal course work which, honestly, if I were to start today from ground zero, I would want because it’s a much more complex medium to get into now than it was. I mean, you couldn’t use half the programming that you can use on the web when we got started.
Esther’s comments bring to mind the findings of generational differences in Selfe and Hawisher’s (2002) study. Among their participants, older technical communicators tended to describe the learning pathway and qualities outlined by Esther. While Esther characterizes herself as a member of an early generation of technical communicators involved in website design, she in fact falls into what Selfe and Hawisher define as a later generation. This might point to some of the differences between Canada and the US in terms of IT education and work. Perhaps the IT field and relevant educational programs developed earlier south of the border. Either way, new educational programs are developing here in Canada which can support the learning of technical communicators without replacing the importance of situated learning.

Only one of the participants, Susan, had gained a formal IT-related credential. While she recognized that situated learning and intuition have contributed to her successes at work and that others respect her technical abilities, she also minimized the value of situated learning and intuition. In discussing her ability to help other staff solve their IT-related problems, Susan acknowledged that she has been able to find a way to solve every problem that she has encountered or that others have brought to her. Still, she qualified her skill and expertise by explaining that “they’re solvable. It’s not very technical problems. Most of the problems don’t require deep involvement with IT like requiring re-programming of…software. Instead, quite often it’s a matter of knowing which program to run and which buttons and commands to use.” Later in her interview, Susan distinguished between competence and expertise:

_I think to become expert you do have to go through formal training. But if you just want to be competent in something then I think it’s more than enough to just sit by the computer and buy a book or buy a magazine and just go through tutorials. But if you want to call yourself an expert in a particular area I do think you need formal training._

If at times the value of situated learning and intuition was qualified by participants, at other times participants seemed to understand that others around them were qualifying these
styles and strategies. The ability to use situated, intuitive learning to extend skills and
experiences seemed overlooked in some work settings, like this one described by Andrea:

Kaela:  Okay. Do...[others] recognize your IT skills and knowledge?

Andrea:  I think some people do and some people don’t. Some..., I think, think I know a
whole lot more then I do. And they just think that I’m the greatest and I can
solve all the world’s problems and make their computers work, and the reality
is that sometimes I can and sometimes I can’t. I think that I’ve been pigeon-
holed in this job particularly, in that they see me as having one set of skills.
And so other things will come up and I won’t even be thought of.

Situated, intuitive learning was recognized as a key strategy by all of the participants. The
alternating attitudes that knowledge gained through formal education is most prestigious or
reliable, and that intuitive, situated learning is critical for effective problem-solving and work
reflects the similarly alternating rhetoric in the knowledge-based society about both credentials
and lifelong and life-wide learning. The role of situated learning is acknowledged and respected
at the same time as it is diminished. This kind of paradox puts people, particularly those who,
like most women in the IT field, lack formal work-related credentials in the position of
qualifying their expertise.

Cultural Encounters

The “Boys’ Club”

While most IT work is considered to be part of the applied science discipline, the technical
communication niche straddles the border between science and the arts. Already gendered as
masculine, science in general and IT in particular pose social, cultural and, as Turkle and
Papert’s (1990), Margolis and Fisher’s (2002), Henwood’s (2000) and Woodfield’s (2000)
studies indicate, epistemological obstacles to women’s inclusion. Working in the technical
communication niche therefore becomes a way for women to succeed in a field in which they are not always comfortable and not always made welcome.

For Esther, discomfort with working in a scientific field surfaced during her education, which began in the sciences. While she had enjoyed studying scientific subjects, just as she continued to enjoy learning about and working with technology, she was disconcerted by the approach taken in science curricula.

Kaela: But it’s not the medium, it’s not the computer that has you hooked in this work?

Esther: No. Or the program. It’s not HTML specifically.

Kaela: It’s about people you want to be working with and also bringing some sort of creativity to your daily work.

Esther: Yeah, yeah. As well as the technology side of things. I really.... That was what disillusioned me about sciences. When I was in high school I was, I mean I was a product of a particular era and I was really good in many subjects.... I was just as good at Latin and English literature as I was at physics and calculus. And I ended up going into sciences because there was this big push for it to be very political for women to be in sciences and I was a really political teenager.... But when I got there I found I was really isolated. I was no longer, you know.... There was no longer room to take creative courses. You just had to take all your science requirements and get your science degree and do a bunch of labs, blah, blah, blah. Whereas, this job has a bit of both and so I feel I’m able to, you know, incorporate both sides.

The similarity between Esther’s stylistic preferences and those of some of the female participants in Turkle and Papert’s (1990) and Margolis and Fisher’s (2002) studies is unmistakeable. Esther enjoys science and technology, but only when she can learn and work in ways that make her feel comfortable and welcome.

Once in the IT workforce, three of the participants discussed their previous experiences of having left jobs in larger IT corporations, partly to escape the sexism that they encountered in
the software development area. Andrea provided a vivid, albeit extreme, picture in her
description of one company where she worked:

_"I worked very, very briefly at one place..., this big dotcom company which ended up
going under and it was very much a boys’ club. The management were all men, they used
to go to lunches at the strip bars and, you know, they had their porn company and their e-
cards company and their webmail company and it was a bizarre environment._

As Melanie further outlined, the most technical, credentialed, masculinized niches of
programming and engineering remain the most problematic for women in the IT field. Talking
about who the IT field might be made more attractive for women, she said,

_Make it more attractive for women? Yeah, busting up the old boys’ network. I mean, it’s
still such an old boys’ network, the domain of software. I mean, you go into a software
company and the programming department is likely to be 80 per cent men. What do they
joke about? They joke about, you know, they make offensive sexual comments. And, as a
woman, you are, you end up being uncomfortable. But what can you say? You are
completely in an environment where you...there isn’t a space to say, you know what,...I
don’t really like that._

Another issue that was seen as potentially problematic for women in the IT field is the
expectation of long hours and the pressures of working to constant deadlines, particularly in the
software development area. Esther relayed a similar feeling about a previous job that she had in a
software development company. Her employer was “so horrible that I...became completely
disillusioned with that whole field. At that time... particularly software development was really
highly gendered as male. It was not a sustainable lifestyle. You were expected to work insane
numbers of hours. It was gross.” Participants recognized that women remain the primary
caregivers in their families, and that family care responsibilities create a tension with work
responsibilities. None of these participants had children and, although some wondered about how
they would balance their responsibilities if they did have children in the future, there was a
general acknowledgement that the IT field can be very demanding of its workers’ time. Esther’s
view of whether or not IT jobs were good jobs for women was that,
I don’t think they’re particularly good for anybody in practice a lot of the time, but I think that women are more realistic about balancing their work life, or more realistic and more demanding about the need to have a balanced work-life relationship. But with things like changes to the Employment Standards Act so that IT is exempt from overtime, I mean, [it’s] pretty hideous. It also tends to be a sector that has very poor benefits because after the sort of, implosion of the field there are fewer large companies and what large companies are there are young... in the relative scheme of things. There’s little or no unionization and so they tend to be these companies that don’t really value things like benefit plans or don’t see those as key to employee retention or anything like that. So... and I think that women judge that when they’re looking for a job and I think they should.... They tend to look for, you know, things that will support more themselves in a job.

Esther’s particular interest in unionization was unique among the participants, and her impression of a lack of benefits for IT workers was not shared by all the other participants. Elaine, for example, relayed stories of the extensive benefits provided to her at work. Esther’s comments point to the importance of the socio-political milieus occupied by these five women, another factor which complicates the understanding and experience of gender, technology, learning and work.

Although Susan recognized the gender imbalance in the IT field and the relatively high presence of women in the technical communication niche, she said little about the boys’ club atmosphere of the IT field. Since her graduation from the online publishing program, she has had very little involvement in and exposure to the IT field. If the programming and engineering niches are conceptualized as the centre of the IT field, then technical communication can be found in a more peripheral location. Of the five participants, Elaine and Susan had so far been the most removed from that centre in their work and studies.

Rewards Found in the Periphery

Technical communication, a niche based less on formal IT-related credentials and encompassing a broad base of skills, abilities and interests, has offered these women an alternative to the most extreme, offensive elements of the IT field. It has continued to provide professional and personal
opportunity in the IT field, for both participants who work as employees of a company and those who work as independent contractors.

Despite the problems that the IT field seems to pose for women, the participants in this study identified a number of benefits to working in the technical communication niche. These include doing interesting work, earning a good income, and having the opportunity to work with others and draw on a wide range of skills and interests. The rewards that Elaine has found in her workplace include a generous allowance in time and money for attendance at conferences and seminars, the ability to purchase books or periodicals, bonuses or gifts to recognize special achievements, and public acknowledgement within the workplace of employees’ contributions and accomplishments, and “lots of time off, personal days. Trips to the art gallery, if we feel like going to the art gallery. Shopping when we feel like shopping and not being at work. Flexibility in our hours. There is trust, holidays, great holidays.” Interestingly, she estimated that, contrary to the IT field in general, “Our office is 60 per cent women.”

Unlike the workplace studied by Woodfield (2000), Elaine characterized her current workplace as one in which staff diversity is sought and embraced. It seems noteworthy that none of the participants in the current study worked in an organization as large as the corporation in Woodfield’s research and that Elaine’s workplace, which seems to present such a strong contrast to Woodfield’s research site, is in a company owned by a woman. Towards the end of her interview, she suggested that her boss might have a different opinion about how gender continues to operate in the IT field and the workplace in general: “I was just remembering something that...[my boss] said to me.... She strongly believes that there are huge cultural barriers to getting into IT. And I think the reason that I’m a little bit rosy is that I am quite privileged to be in the environment that I’m in.”
In a light-hearted tone, Melanie reflected on the real difference between technical communication and other niches in the IT field: “I mean, I also find people in the area of technical communications, they tend to be more irreverent towards the whole computer industry.” I understand this as Melanie’s way of expressing her refusal to live a life ruled by work or computers, and her understanding of the technical communication niche as one in which workers appreciate multiple priorities and interests. The technical communication niche has offered these women the benefits of work in the IT field, and accommodated both women and the skills or styles gendered as feminine. It allows women to work outside the boys’ club and, as Melanie notes, serves to “mitigate that environment. But that structured environment exists around them.”

**Am I an IT Worker?: Creating Identity**

Susan’s lesson about the importance of timing in finding work and building a career creates a picture of the technical communication niche in the IT field as one with a centre and an increasingly large periphery. Further away from the centre than she would prefer to be, Susan has retained an affiliation with the technical communication niche and the IT field. She explained her career aspirations and her current situation in the following exchange:

*Susan:* I would say…I mean, I would like to think of myself as an IT worker and I tried working in the IT field exclusively, but I just can’t get a job. So that’s why I kind of wound up, you know, doing this. So, I think right now I wouldn’t say I’m an IT specialist. And if people do ask me, I will say, oh, I’m a…secretary who does basically what I just told you.

*Kaela:* Do you think that other people around you think of you as an IT worker, or an IT specialist?

*Susan:* I think in this…[office], yes. Yeah. Because I do find that whenever they’re having problems with their computers or hardware, when they have to hook up stuff, they do come to me. So I think to them, maybe I am an IT specialist.
Susan’s uniqueness among the participants in this study, as a woman who has a formal IT-related credential, was reflected in her self-identification as an IT worker. Despite their enjoyment in learning about and working with IT, other participants were less likely to identify themselves or want to identify themselves as IT workers. Woodfield (2000) uses the word “provisional” in her research to characterize female programmers’ attachment to technology and the IT field. This is comparable to how the remaining four participants in the current study described their identity. They were more likely to identify themselves in terms of the context of their workplaces and the contributions that they were able to make to the larger mandates of those workplaces, rather than in relation to the IT aspects of their work.

While both Elaine and Esther initially agreed that they were IT workers, after some reflection, they focused on another aspect of their work and used the same word to characterize their identity. As Esther explained, “I mean, yeah, if I go to, you know, some survey and I have to categorize it that’s where I think of...[myself]. But in terms of the skills I have it does come back to being, sort of more entrepreneurial skills over IT skills.” Both women now work in companies that focus on developing online business strategies and websites. Both could envision a future of operating a business in which IT was used, but was not necessarily as connected to the IT field as their current workplaces are. Talking about her future, Elaine saw herself,

> running my own business...probably not IT, but I’ll be using all of these skills.... I like it, so I’ll always use it and I’ll always be aware of what’s going on in it and I’ll always have the skills and I’ll probably always want to improve my skills. But in my formal work setting I can see myself doing all kinds of different industries and careers.

These similarities in Elaine’s and Esther’s identities and future plans seem striking, especially given their previously noted participation in established professional networks. The relationship between participation in formal networks and self-identification as an entrepreneur emerges as an interesting, but unexplored, question in this study.
The remaining two participants, Andrea and Melanie, described their identities in still different ways. Having completed a formal education program in graphic design, Andrea continued to identify herself as a designer. An IT worker, for her, “is someone who does stuff that I don’t understand…. It’s way more higher level, sort of, development, like systems, programming, software development and stuff that I just don’t understand at all. It’s the people that I deal with on a daily basis, but not me.” Recognizing that identity is a relative, rather than an absolute, construct, Andrea also acknowledged that “probably other people [who are less involved in IT work] do see me as an IT person because they see me as being the techie.”

Of all the participants, Melanie remained the most adamant that she did not identify herself as an IT worker. For her, identity remained based in her interest in writing and publishing. The term “IT worker” was not familiar to her, and not one that she thought others would likely apply to her. “You see,” she explained, “IT work focuses on the technology. And, to me, that’s kind of a misidentification of a certain kind of work that can be done.” She went on to discuss the particularities of her work, articulating a disdain for IT work which is driven by technological potential rather than by organizational missions and social development. Like Andrea, Melanie had most recently worked in the non-profit sector. These two women shared an understanding of their occupations as a way to contribute to the social justice mandates of the organizations where they worked.

The five women participating in this study spoke about several different identities within the IT field, the broader labour force and society at large. The construction of worker identity is a complex process. It involves factors such as workplace structure and systems, credentials, work responsibilities, career aspirations, and the relationship between those things and other priorities and forces in life. As the previous section indicates, Andrea, Esther and Melanie were acutely
aware of how the technical communication niche afforded them a way to work within the IT field while remaining outside the “boys’ club.” In this context, the reluctance to identify themselves as IT workers seems, for some of the participants, to take on a self-protective rationale, as they refuse to align themselves with the elements of the IT field that they find offensive.

The Role of Passion
Irrespective of how the participants in this study constructed their identities and how they came to work in technical communication, their comments left me with a sense of how passion and conviction have guided their educational and career decision-making. From European studies to communications to environmental science, Melanie, Esther and Elaine described their love of the areas that they studied in university. “I loved studying environmental sciences,” Elaine explained, “I just wasn’t sure whether or not I wanted to work...There was government opportunities available and I wanted to do something more in the private sector.” Having studied in another area, Melanie described how she “was ready at that point to sort of let go of, you know, everything that I had studied because that had gone on for a number of years and I had sort of satisfied my curiosity as far as that was concerned.”

Particular interests might develop and subside for participants over time, but what seems to remain constant is the importance of attaching a longstanding, passionate interest to studies and work. For Susan, her passion around design and publishing led her almost naturally to study internet publishing. She made this decision despite her parents’ wishes that she focus on a more established professional arena with “real” jobs, and still hoped to be able to shift her career back towards the IT field in the future.
Andrea also enjoyed the work of design and publishing, and this led her to complete a program in graphic design. Her passion was evident, but it was not for the graphic design work; it was, rather, for the social change and social justice causes of the non-profit organizations where she has worked. Having gained a particular set of skills and a base of knowledge, she has been able to make a meaningful contribution to the work of value to her. She identified as a designer professionally, at the same time as she characterized her work as part of the “social activism” that has long attracted and engaged her. “And so I’ve actually managed to find sort of a niche in the non-profit world which is also really good. I worked in the corporate world for a while and...[it] didn’t do anything for me. I didn’t find it interesting, I didn’t feel good about myself at the end of the day,” Andrea explained.

Melanie had a similar interest in publishing, and has been developing a greater interest in writing. Like Andrea, she had most recently worked in the non-profit sector and was convinced that she would never go back to work in the corporate part of the IT field. She hoped to leave the IT field eventually and move her career focus closer to the areas of writing and publishing. Technical writing has kept her connected to those areas, but she has become “completely bored with the idea of running off and learning about software, and running off and learning about, you know, the next great HTML single source online help and user guide tool.” Until she is able to reposition her career, Melanie has found meaning and value in her recent technical communication work with a non-profit organization. Commenting on her strengths, she had the following thoughts:

Melanie: And, what other strengths do I have? Um...I think the other thing...I seem to be able to motivate people. And I really believe in the work that I’m doing. I mean, believing, like, I know it’s not really a strength, I think that it is...

Kaela: It’s a strength, not necessarily a skill.
Melanie: Yeah, yeah. I mean I really believe in the work that I do, so...

Elaine and Esther, the two participants who identified themselves as entrepreneurs, also talked about their futures, which they saw as increasingly distanced from the centre of the IT field and focused on their areas of passion. Both envisioned a future of owning their own businesses which they could develop to meet their financial needs and fulfil their interests. For Esther, this meant moving into “more of a strategic consulting role,... And probably moving...away from the technical stuff.” Growing a business into a large corporation was not the issue for either of them; feeling energized and committed to the business’s nature and mission was. The following excerpt from Elaine’s interview expresses this ambition:

Kaela: And in the future, where do you see yourself working?

Elaine: I do see myself running my own business.... I am not a particularly career driven person. I love working. I love variety. I love challenge. So I wouldn’t necessarily want to move up a...[as if] I’ve got a path and when I’m 50 I’m going to be doing this.

Kaela: So you’re not climbing a corporate ladder? You want to find what it is that’s fun, that challenges you, that fits with your life.

Elaine: That keeps me passionate and motivated and keeps me excited about getting up every day and when certain things aren’t doing it for me anymore I want to move to the next thing.

To a certain degree, some of the participants in this study shared passions, despite their differences in background, perspective on gender politics and personality. Presumably, passion will continue to guide the direction of these women’s careers as other factors, such as the socio-political milieu in which they live and their own political or philosophical perspectives, personal circumstances and developing opportunities, will give shape to their work in more distinct ways.
Summary

These themes are inter-related in the lives and work of the participants in this study. Identity, for example, is connected to, but not limited by, gender, learning and career pathways or passion. As the published literature concludes, this study has suggested that technology and IT work is gendered as masculine. The women in this study have responded to that problem in ways that are sometimes markedly similar and sometimes more divergent. By utilizing their diverse skills, styles and interests, and providing a creative and social outlet, the work of technical communication has offered these five women a niche in which they can reap the benefits of professional work in the IT field. At the same time, it has buffered them from what many women have encountered as the most noxious elements of that field.

The emergence of the themes outlined above illustrates how gender continues to operate in the sphere of education and work. Contemporary feminist standpoint theory acknowledges that, while gender remains a pivotal determinant of privilege, on women’s side of the dividing line there are many other possible divisions. Some of the women in this study acknowledged their privilege and, occasionally, good luck. Still, among these different women there were repeated references to their experiences of gender-related insensitivity to their styles, contributions and needs. Although much of the previously conducted research about women and IT has focused on women in the programming niche, the findings in this current study are largely consistent with those studies. They raise a series of implications for further research, learning and work, and policy, discussed in the final chapter of this paper.
CHAPTER 5:
IMPLICATIONS AND RECOMMENDATIONS

This research began with a series of questions. How do women in the IT field, particularly in the technical communication niche, understand their own experiences of work, learning and technology? What is it about technical communication which either draws women to it or, for other reasons, becomes the work of women? What do the experiences of the women in this niche suggest about the wider IT field? How do they relate to the broader issues of women’s learning and work histories, and to relevant public policy?

As the previous chapters outline, women’s experiences of technology, learning and work can come to be understood and expressed as gendered. These experiences and understandings might differ from woman to woman, as other factors complicate the meaning and impact of gender. The complicating factors which seem most evident in this study are participants’ ages and socio-political milieus. Other important factors, including class and race, were undoubtedly operating in these women’s lives; however, the homogeneity among them especially in terms of class makes the role of these factors less clear.

For these five women, technical communication has become an attractive niche within an often unattractive IT field. It offers many of the benefits of the IT field in general, such as status, income and challenge, at the same time as it shields them from some of the problematic masculine aspects of the field and affords them an opportunity to use their preferred learning and work styles. In the closing pages of this paper, I outline the implications that I have drawn from this research and present a number of recommendations to further understand and support women’s work in the IT field.
Research

To date, most of the research on women in IT-related education and work has focused on the niches of programming or engineering. This includes demographic research, such as the studies by Statistics Canada or Millar and Jagger’s (2001) international study, and qualitative studies such as those conducted by Turkle and Papert (1990), Margolis and Fisher (2002), Henwood (2000) and Woodfield (2000). The research of Selfe and Hawisher (2002) is an exception; however, in their analysis gender is a secondary concern. With the expansion of the IT field and of IT-related educational programs to include the technical communication elements of website design and technical writing, it is becoming clearer that IT education is much more than computer science and that IT work is much more than programming or engineering. The published research has provided important commentary on gender, epistemology and gender-based marginalization in IT education and work; however, its general focus on niches in which women are so extremely under-represented contributes little to our understanding of the diversity of women’s strategic responses to the knowledge-based society and masculinized technology. An expanded research focus incorporating the work that women tend to choose within the IT field is important for future research about women, gender and technology.

I have already mentioned that the participants in this study share a similarity in class. Few of the other studies reviewed concentrate on inserting factors such as class, race, age and – seemingly overlooked entirely – dis/ability into their analyses. The analysis in this paper begins to suggest how some of these and other factors operate in women’s learning and work, but does not explore them sufficiently. A more conscious and comprehensive incorporation of these other factors is important for future research on women in the IT field.
As a study that has contributed to the body of research about women’s IT learning and work, mine has used a phenomenological methodology and a feminist standpoint theoretical analytical framework. Phenomenological research is filled with open-ended questions and answers based on personal understandings of both participants and researchers. While no research is final, the conclusions of phenomenological research can seem especially tentative. Participants’ answers give rise to new questions, which can only be addressed in new research. One question emerging from this research is how participation in established networks might be related to self-identification as an entrepreneur. All of the participants in this current study discussed the importance of support from colleagues, supervisors or mentors to their IT learning and career development; however, only Elaine and Esther, the only participants who clearly adopted an entrepreneurial identity, mentioned their participation in networks such as Wired Women as another important source of learning and support. Are women who identify as entrepreneurs more likely to participate in formal networks? Are networks like Wired Women perceived by women in the IT field as a forum for entrepreneurs and not appropriate for other women? Or, is the presence of the link between networking and entrepreneurialism in this study merely a coincidence? For the women in the IT field who are trying to support one another’s learning and work by building networks and associations, these are important questions still waiting to be explored.

A phenomenological study is a part of a conversation, and the conclusions of one study invite the questions and voices of other researchers and participants. This current study has involved a very small number of participants, and larger scale studies are needed to add both substance and trustworthiness to it. For these reasons, I hope researchers continue to find women’s learning in the IT field, both inside and outside the technical communication niche, a
Learning and Work

Despite the general focus in the literature on programmers and engineers, this study reiterates findings in other research of a range of learning and work pathways into the IT field. As the literature would suggest, most of the participants in this study did not have formal IT-related credentials. Only one person had completed a certificate in online publishing, and she shared the other participants’ view that situated or experiential learning is a necessary part of IT work. On the other hand, all participants had some level of university education and appreciated their experiences of formal education, even if it was not directly related to their IT work. Consistent with the concepts of lifelong and life-wide learning, these findings suggest that women gain knowledge, skill and competence relevant to their IT jobs in a variety of ways.

Despite the general lack of formal IT-related education, some participants thought that credentials are increasingly important in the IT field. Esther mentioned that, if she were starting in the field today, she would participate in a formal education program which was not available when she had begun working in the field. Susan explained that, in her mind, expertise was developed through formal education, although competence could be developed through less formal, experiential learning.

Given the diversity in learning options and strategies available to women in today’s IT field, it is important for employers to clarify the skill and knowledge requirements of a job. As Selfe and Hawisher (2002) explain, the time lag between changes in the workplace and expansion of educational programs and credentials is acute. One of the lessons of this type of
rapid change is that employers cannot always look to a credential as a way to define work-related
skills and knowledge.

Occupational competencies and prior learning assessment and recognition (PLAR) have
gained some attention in Canada and British Columbia. My exposure to these concepts and
processes is based in my previous employment in the community social services sector. From
1998 until 2002, I sat at a provincial table where representatives from employers’ associations,
unions and professional associations, post-secondary institutions and government policy offices
came together to develop a series of sector-wide occupational competency tools for use in a
variety of settings.\(^{16}\)

Within educational institutions offering PLAR programs, students can apply to have such
knowledge and skills credited in their completion of a formal education program. Typically, up
to 50 per cent of a program’s course requirements can be replaced in this way. This avoids the
problem of students’ having to complete course work which is, for them, redundant and provides
formal recognition of their experience, knowledge and skills. PLAR offers welcome benefits, but
remains a cumbersome process for both educational institutions and learners.

Occupational competencies can also be used by employers and workers. My
colleagues and I who worked to develop competency-based resources for the community social

\(^{16}\) That was the table of the Multi-lateral Task Force on Training, Career Pathing and Labour Mobility, which
received logistical support from the Centre for Curriculum Transfer and Technology (known as C2T2). These bodies
have disbanded as a result of funding cutbacks initiated by the current provincial Government. According to the
website of C2T2 (www.c2t2.ca), the Justice Institute of BC was scheduled to assume leadership of the Multi-lateral
Task Force, renamed the Council for Career and Workforce Development in the Community Social Services, as of
March 31, 2004. At this time, I have been unable to find reference to that Council on the website of the Justice
Insitute (www.ji.bc.ca).
services sector envisioned a set of tools which could be applied in the workplace. Employers could use the tools in hiring and evaluating staff, and individual workers could use them in their own career planning and skill assessment. For professional associations, the tools could be used in the establishment of standards, and for certain government offices they could prove useful in updating relevant regulations.

The concepts of lifelong and life-wide learning imply that established competency is often just as valid a measure of qualification as a formal credential is; sometimes, it might be more so. Efforts to bring PLAR into IT-related educational programs and identify key competencies for IT jobs should be encouraged. PLAR programs would offer particular benefits to mature students, enabling them to look to formal education as a strategy to fill gaps in their knowledge and skills. For employers, use of a competency-based approach in hiring and evaluation of employees would help shift the focus in decision-making from a reliance on credentials to the broader consideration of ability, particularly in the technical communication niche. Unlike the work of programmers and engineers, the accomplishments of technical communicators are often visible and appreciable even for employers who might not have technical expertise, making competencies more easily identified and assessed.

Although recognition of situated or experiential learning is especially important for the majority of women in the IT field who do not have formal IT-related credential, some women do decide to participate in formal IT-related education programs. For them, curriculum development has emerged as a major issue. Women’s apparent preference of a learning style which concentrates on concrete applications, rather than abstract formulations, has implications for especially for computer science and engineering programs which have remained more abstract. Notwithstanding Henwood’s (2000) study, which suggests that curriculum changes might not be
sufficient to overcome gender imbalance and discrimination, interdisciplinary options in educational curricula should be pursued. Henwood also notes cases of overt harassment by male students of female students that went unaddressed by teachers in her study’s interdisciplinary program. Margolis and Fisher’s (2002) finding of increased representation of women in the Carnegie Mellon computer science program suggests that the full support and commitment of the educational institution, including teaching faculty and administrators, is important in initiating positive change in women’s experiences of computer science education.

Beyond formal educational settings, several professional associations exist to support IT workers. While some of the participants in this study were familiar with some of those networks, only two of them participated regularly in such organizations. Participation in networks and associations might not appeal to all women in the IT field and might not deliver meaningful learning or support for them. Still, this finding has implications for those organizations, including organizations mandated to support women in the IT field. Perhaps they have not yet captured the attention of their potential members, perhaps they are not delivering some key services and benefits, or perhaps some women find them exclusionary. These are possibilities that the various networks and associations in Canada’s IT field should explore.

Once in the workplace, women have expressed concerns about the often stringent demands of IT work. The participants in this study reflected these concerns. Several participants explained that moving into a technical communication niche removed from the software development area was part of a strategy to escape these extreme demands and create a more balanced life. Esther was especially articulate about the confusing role of employers in this province, as they have attempted to attract women into the IT field at the same time as they have lobbied for exemption from regular employment standards. If employers in the IT field,
represented by the BCTIA, are serious about attracting women into this field, research indicates that they need to shift their recent strategies, and create workplaces which accommodate, rather than ignore, the real-life demands experienced by their workers.

Policy
Efforts to broaden learning strategies are a consideration for policy-makers as well as educators and employers. The overall usefulness of PLAR has already been acknowledged by government policy-makers and post-secondary educators in other sectors. This strategy seems particularly relevant in the IT field which is experiencing a shortage of credentialed workers. In Canada, post-secondary education and training fall within the mandate of provincial governments, and it is at this level that policy around PLAR can yield that greatest results.

Policy needs to acknowledge that both women and men can undertake educational and career shifts at many points in their lives. For many IT workers, including the participants of this study, education and career pathways are not straight; they more typically curve through different interests, disciplines, external forces and opportunities. Most of the policy and program interventions aimed at encouraging women to consider IT-related education programs and careers are directed at children and high school students. These efforts should be broadened to accommodate women at all stages of career development. PLAR and career transition comprise two imperatives for the IT policy community.

Policy-level bodies in the European Union have been active in the attempt to rectify the gender imbalance throughout their scientific and technological communities. I concur with a number of policy recommendations made in a recent report by the European Technology Assessment Network Expert Working Group on Women and Science (2000). These include
initiatives to equalize gender representation on relevant policy-setting bodies, increase the presence of women in faculty and research positions in science and technology programs, and alleviate gender-related pay inequities. In this country and province, efforts to establish pay equity in the public sector should be reconfirmed and broadened into the private sector. A competency-based system of standards for occupations throughout the IT field would support PLAR and help ensure fairness in hiring, evaluation and wages. Hiring targets for science and technology programs, particularly in public post-secondary or research institutions and government offices, would help women gain a foothold in senior level, visible work in the field.

Part of a policy-level commitment to addressing gender issues in the IT field could involve the creation of provincial and federal research and advisory boards. Currently, the employers’ association in this field, the BCTIA, holds a distinct advantage in steering provincial policies affecting IT workers. This influence is found in the amendments to the provincial Employment Standards, exempting high-technology workers and workplaces from regular constraints. This type of sole influence is consistent with the current provincial and federal Governments’ general tendency to privilege corporate interests over worker or citizen interests, as they orchestrate the implementation of a market-driven ideology. The voices and concerns of IT workers have been absent, and need to be heard and empowered in the policy arena. Any new Government-struck boards or commissions should include representatives from IT worker associations, as well as representatives from educational institutions, government offices, and employer associations. Because the under-representation of women in the IT field has been widely identified as a concern, women’s organizations, such as Wired Women, must be included in this work.
A Few Final Thoughts…

Over the course of this research, I have learned a great deal about technology and IT work, and something about the women who work in the IT field and its technical communication niche. I have had a longstanding interest in gender issues. Coming to understand how gender is constructed even around inanimate technologies and throughout this entire field of work has deepened my awareness of gender’s continued operation and influence in our society.

When I have talked about this research with acquaintances, many have asked if I am interested in pursuing a career in this field. Initially, they were surprised when I responded emphatically, but negatively. “Why not?” they asked. “Because I have no interest in computers. My interest is in gender,” I answered. I also had a sense that I would find the IT field unpalatable, in the ways that the participants in this study described.

As I have continued to have these conversations, I have found myself reflecting on what the participants said in their interviews and relating their comments to my own experiences. Like them, I have always been comfortable around computers, using them in my academic and professional work. With almost no formal IT-related training or support, I became skilled with commonly used software. Over time, the role of IT in the workplace has grown and my jobs have provided opportunities to expand my IT skills. When I started one particular job, I took over the production of a small organizational newsletter. Its lack of design integrity bothered me and, when the organization purchased a new computer, I made sure that it came with a desktop publishing program. I learned how to use that program, and redesigned the newsletter. In a more recent job, I was charged with coordinating the redevelopment of a website. I could have looked for a contractor to do the design work; instead, I chose to learn how to use DreamWeaver software and try to do the work myself. With some nonformal tutoring from someone who had
used that software and some technical support from a professional website designer, I was able to do most, although not all, of that work.

Now when I ask myself about entering the IT field, my answer seems less definite. By the standards of the youthful IT field, I am already old and an unlikely candidate for successful transition into that field. At the same time, I am aware that the IT field has enlarged so much that it has become, in some way, a part of my work. Parts of IT work – the creativity, the information-sharing, the ability to control production and dissemination of resources that are really helpful to others – appeal to me. I share the confusion of some of the participants in this study about professional identity; like theirs, my learning and work pathways have taken many turns and I am increasingly encountering IT as I move forward.

Learning and work in the IT field and the larger knowledge-based society are turbulent, challenging and complicated. In my final reflections, I have been most impressed by the passion and conviction which continue to motivate the five women who participated in this study. These qualities have helped them clarify the purpose of technology and their work, and steer their careers along paths that can seem bumpy and uncertain.
REFERENCES


High technology professionals and high technology companies in British Columbia.


Dear [Contact Name]:

Dr. Shauna Butterwick, Assistant Professor, Department of Educational Studies, University of British Columbia and Ms. Jen Liptrot, Executive Director, Advocates for Community-based Training and Education for Women (ACTEW) are looking for participants for a study entitled Women’s Alternate and Informal Learning Pathways to Jobs in the IT (Information Technology) Sector: Phase One. The purpose of this study is to explore and document women’s alternate and informal learning pathways to jobs in the IT (Information Technology) Sector. We want to explore and document the alternate and informal pathways women create and utilize to acquire skills and knowledge for, and to access jobs in, the IT Sector (considered to be ‘good jobs’ in the ‘new economy’). This case study is one of several other case studies being undertaken by others researchers across Canada who are part of a part of a larger project which is exploring the current forms, contents, and outcomes of organized educational, training and informal learning activities in Canada's economy. Funding for this project has been secured from the Social Sciences and Humanities Research Council of Canada (SSHRC).

We hope that this study will help to fill some gaps in knowledge about how women learn and access jobs in the IT sector. We already know that women are a minority within traditional formal educational routes to access the IT sector (e.g. engineering, mathematics and computer sciences) and that women’s participation in these programs is dropping. Research also shows that women are a minority of IT workers and that they receive lower wages relative to men working in the IT sector. What is less well documented and understood are the ways women learn skills and knowledge about and subsequently access careers within the IT sector through alternative educational pathways and informal or nonformal learning. Systematic investigations are needed to document women’s alternate and informal learning and the outcomes of such learning in relation to accessing jobs and acquiring equitable wages. This case study will address these gaps using a gender-sensitive approach--one which seeks to examine how gender, race, class and disabilities (to name a few) influence women’s opportunities and experiences.

We hope that by focusing on women's informal and alternate learning pathways, a more a complete picture can be created which will lead to more effective policy and programs. The results of this larger case study will be shared with all of the participants. We also want this research to help inform organizations and programs that assist women to make informed choices about jobs and careers and those organizations that are particularly concern with supporting women’s work in the IT sector. We want this study to inform policy makers at the provincial and federal level. Finally, the outcomes of the research will be shared with other researchers concerned with developing a more comprehensive understanding of the extent of informal learning being undertaken by workers in the new economy and with researchers...
who have a particular interest in using research to better understand and support the variety of women's learning pathways.

We are in the first phase of this case study which involves a review of academic and popular literature and interviews and focus groups. Information and data gathered during this first phase will help lay the foundation for future data collection. We are hoping to talk to women who have learned their IT skills in a variety of contexts such as:

- Women changing careers into the IT sector through alternative informal/nonformal learning pathways.
- Women who are still in school and making careers decisions.
- Women who have successful careers in the IT sector.
- Women who are in formal IT training programs.
- Women entering through alternative pathways who experience discrimination due to lack of formal credentials.
- Low income/poor women in welfare-to-work training programs and those who learn IT skills informally (and through self-directed inquiry) in relation to their organizing and advocacy activities.

During this first phase of the study, we hope to locate women who are willing to be interviewed and for these interviews to be tape recorded. We anticipate these conversations will last between 1-1.5 hours. Following the interviews we will send participants the transcriptions and we will follow-up with email correspondence to encourage further interest in and feedback on the research. All in all we anticipate that participating in this phase of the research project will take up about three hours of your time.

In a couple of weeks, we will be contacting you by phone, emails or in face-to-face discussions to answer any questions about the study and to determine your willingness to participate. If you are willing to participate, we will ask that you sign a consent form, which we will send you prior to the interview (it will contain information similar to this information letter). Prior to the interview, we will also send you a list of key issues and questions we hope to cover in the focus group. We want your feedback on the effectiveness and appropriateness of the topics being explored and if they result in information useful to our study. We also want to know if there are areas we have not thought about, but which you believe are important to consider and will also ask you to suggest other women whom you think might be interested in participating in the study. These women will be sent information letters, which will be followed up with phone calls. There are no known risks of participating in this research and we hope participants may find it valuable. At the end of the study we will be providing a summary of the research findings to all the participants.

All data gathered during the interviews will only be accessible by the two researchers, Shauna Butterwick and Jen Liptrot, and by graduate students who we will be hiring to assist us with the project. These graduate students will be trained in conducting interviews and about the importance of maintaining confidentiality. No other individuals will have access to this data. Pseudonyms will be used to identify participants and any other individuals or institution and agencies discussed during the focus groups. We will keep transcripts, tape, and other data in a secure locked cabinet. At any time during the research process, participants can decide to withdraw without any consequences or reprisals. Participants do not waive any of their legal rights by consenting to participate in this research.

If you have any questions about this study, please do not hesitate to contact us. Shauna Butterwick can be reached by phone at 604-822-3897 and by email at shauna.butterwick@ubc.ca. For Ontario-based participants, Jen Liptrot can be reached by phone at 416-599-3590 and by email at jen@actew.org. If at anytime you have questions about your treatment or rights as a research subject, you may telephone the Office of Research Services at the University of British Columbia at 604-822-8598.
We will be contacting you in about two weeks time to discuss this project, answer any questions, and determine if you are willing to be interviewed. Thanks for taking the time to read this information letter.

Sincerely,

Shauna Butterwick, Assistant Professor, Department of Educational Studies, UBC

Jen Liptrot, Executive Director, ACTEW
APPENDIX 2: LETTER OF CONSENT

Title of Research Project: Women’s Alternate and Informal Learning Pathways to Jobs in the IT (Information Technology) Sector: Phase One

Researchers: Dr. Shauna Butterwick, Assistant Professor, Department of Educational Studies, University of British Columbia, PH: 604-822-3897; email: shauna.butterwick@ubc.ca
Ms. Jen Liptrot, Executive Director, Advocates for Community-based Training and Education for Women (ACTEW), PH: 416-599-3590; email: jen@actew.org

Purpose of the Study: The purpose of this study is to explore and document the alternate and informal pathways women create and utilize to acquire skills and knowledge for, and to access jobs in, the IT Sector (considered to be 'good jobs' in the 'new economy'). This case study is one of several other case studies being undertaken by others researchers across Canada who are part of a larger project which is exploring the current forms, contents, and outcomes of organized educational, training and informal learning activities in Canada's economy. Funding for this project has been secured from the Social Sciences and Humanities Research Council of Canada (SSHRC). Focusing on women's informal and alternate learning pathways will provide more a complete picture which will lead to more effective policy and programs. Pilot interviews are being conducted with women learning IT skills in a variety of contexts including women working as advocates in movements and organizations for social justice, women learning IT skills through their studies in the humanities, women occupying clerical positions learning IT skills through informal on-the-job learning, women involved with women’s IT organizations, women with jobs in the IT sector who have acquired their IT skills through a mix of both formal and informal means. These pilot interviews will help to determine the effectiveness of the interview guidelines/schedule and to identify additional potential participants.

Procedures: the following procedures will be adhered to in this study:

- Interview guidelines will be provided to participants prior to the interview
- Interviews will occur at a date and time convenient to participants and the researcher and will take about one 1-1.5 hours
- Participants will be asked to provide a copy of their resumes to the researchers
- Interviews will take place either face to face or over the telephone if meeting in person is not possible
- Interviews will be tape/audio recorded if participants give consent
- Transcripts of the interviews will be sent to participants following the interviews and, if requested, copies of the tapes will also be sent
- Participants can delete and add to their transcripts
- The researcher will contact participants after they have received the transcript to discuss the interview
- Total time required is approximately two hours.
• Participants will be asked to suggest other women who they think might be interested in participating in the study.
• At the end of the study, all participants will be sent a summary report of the research.
• All information will be gathered and is accessible only by the research team which consists of Shauna Butterwick and Jen Liptrot and graduate students who may be hired to assist with the project. These graduate students will be trained in conducting interviews and about the importance of maintaining confidentiality.
• No other individuals outside of the research team will have access to this data.
• Code numbers will be assigned to each interview tape and transcript and pseudonyms will be used to identify participants and any other individuals or institution and agencies discussed during the interviews.
• Data (tapes, transcripts) will be kept in a secure locked cabinet.
• Participants can decide to withdraw at any time throughout the research process without any consequences or reprisals.
• Participants do not waive their legal rights by consenting to participate in this research.
• If participants have any questions about this study, at any time, they can contact the researchers.

If at anytime, participants have questions about their treatment or rights as a research subject, they may telephone the Office of Research Services at the University of British Columbia at 604-822-8598.

Consent: Please check the appropriate statement:

_____ I consent to and understand the above mentioned procedures and I have a copy of this consent for my records.

_____ I consent to and understand the above mentioned procedures, but I do not wish to have the interview tape recorded, and I have a copy of this consent for my records.

__________________________________________ _________________________
Signature of Participant       Date

__________________________________________ ____________________________
Signature of Researcher/Witness     Date
APPENDIX 3:
INTERVIEW SCHEDULE

(Revised October 2003)

Research Project: Women’s Alternate and Informal Learning Pathways to Jobs in the IT (Information Technology) Sector: Phase One

Introductory Comments
Thank you for agreeing to participate in this study. As was mentioned in the information letter and consent form, we are interested in your experiences of informal and alternate learning processes where you have acquired information technology skills and knowledge. The main objective of this project is to create a more comprehensive understanding of women’s learning pathways to IT jobs. This study can also contribute to a better understanding of women’s informal learning more generally. We hope this information can help inform policy and initiatives that are aimed at supporting and encouraging women to consider careers in IT. We also hope this study can inform policies and programs that focus on work-related learning. We are also connecting with women’s IT advocacy organizations to provide them with information that can help their efforts. As a result of the many conversations we have with women, we will also be developing an online survey and posting useful information for women in IT on ACTEW’s and other IT organization’s websites. The results of our analysis will be presented at conferences and workshops and will be published in academic journals and books as well as through other venues.

It is important to remind you that you can decide to withdraw from the study or not answer questions at any time. We would also appreciate participants sharing their resumes. Before beginning with our research questions, do you have any questions or concerns about the study? Are you comfortable with the interview being tape recorded?

Background and Demographic Information
If you are comfortable with sharing this information, please tell me your age, where you were born, your current family status (single, in a relation, children), your citizenship, how you would define your ethnicity or cultural ancestry, your educational background, and your work history (briefly) up until your current position.

IT Skills and Work
Please tell us your current job title and outline your tasks and responsibilities. Does your job title reflect what you actually do? Do you see yourself as an ‘IT worker’? Do others (e.g. colleagues, bosses, friends and family) see you as an ‘IT worker’?

When you were being hired for this current job, what were your expectations and your employer’s expectations? How to these expectations compare with what you currently know about your job?

How much of your current work relates to information technology knowledge and skills?

How would you describe your skills? What are your strengths and what skills do you want to develop and/or improve?

How have you acquired your knowledge and skills? What kinds of training have you taken? What other resources do you use to develop your knowledge and skills (i.e. other colleagues, the internet, books, etc).

How effective are these various learning resources? Do you take work home and does your learning process extend beyond regular work hours?

What role does intuition (if any) play in your learning or problem solving process? What does intuition mean to you?
We are often not aware of our informal learning processes. Please describe a recent or memorable moment where you had to learn something new—what did the process look like? Technology is rapidly changing so that IT workers must constantly update their knowledge and skills. How do you feel about that and how does it affect your learning? What kind of support for your learning do you receive? What kinds of obstacles or difficulties in learning have you encountered? Who do you think is responsible for this learning? Can you think about a particularly rewarding and a particularly difficult moment in your learning process? Are you involved with helping others learn IT skills and knowledge? If yes, please elaborate. What is satisfying about your job? What is frustrating about your job? Outside of paid work, do you use your IT skills (e.g. volunteering, hobbies, family)?

**Perspectives About Jobs in the IT Sector**
Technology and developing technology skills have been regarded as crucial to succeeding in the new ‘knowledge economy’; what are your views of technology and the need for technology-related skills? Are IT jobs good jobs for women? Why? Which aspects of IT jobs are not good for women? Why? What changes do you think would make this job sector more attractive to women? Were there things you wished you knew about IT jobs earlier in your work life? What advice would you give other women about IT work? In the future, where do you see yourself working?

**Rewards/Recognition of IT Skills**
Do other work colleagues (including your boss) recognize your IT skills and knowledge? Does your salary reflect what knowledge and skills you have? Are there other ways that you are rewarded or your skills recognized? What barriers to recognition of your IT skills have you encountered? What has supported your IT skills and knowledge being recognized?

**Advice for Us**
What issues do you think we should be focusing our attention on in this study? What have we missed that you believe is important? How should we share the result of this study and with whom? Can you think of someone you know who would be interested in participating in this study? How was the recruitment and interview process? What would you change about the process? What has been useful about the process?

**Closing**
Thank you for taking the time to speak with us. We will be transcribing this interview and sending you a copy within a few weeks. Let us know if you would also like a copy of the audio-tape. Remember when you read the transcript that it is a conversation, not a formal written document. You can delete parts of your transcript and add to it as well. We will be using pseudonyms to identify you in the study. After you have received the transcripts we will be contacting you by phone to discuss the interview, clarify parts of our conversation, and seek any further advice you might have for the study. Thanks again.
APPENDIX 4:
GLOSSARY OF ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>AAUW</td>
<td>American Association of University Women</td>
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<tr>
<td>ACTEW</td>
<td>A Commitment to Training and Employment for Women (previously, Advocates for Community-based Training and Education for Women)</td>
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<tr>
<td>BCTIA</td>
<td>British Columbia Technology Industry Association</td>
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<tr>
<td>CIPS</td>
<td>Canadian Information Processing Society</td>
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<tr>
<td>CT</td>
<td>Computers and telecommunications</td>
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<tr>
<td>HTML</td>
<td>HyperText Markup Language</td>
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<td>ICT</td>
<td>Information and communications technology</td>
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<td>IT</td>
<td>Information technology</td>
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<tr>
<td>ITEC</td>
<td>Information technology, electronics and communications</td>
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<tr>
<td>PLAR</td>
<td>Prior learning assessment and recognition</td>
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<tr>
<td>WISE</td>
<td>Women in Science and Engineering program, UK</td>
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Describing effective communication as a 2-way street is passé. Communication is much more complicated, and leaders at all levels need to know a whole lot more than the mechanics of sending and receiving information. Here are some things to remember about communication for leadership: How Important Is Communication for Leaders? It’s critical. You must learn to handle the rapid flows of information within the organization, and among customers, partners, and other stakeholders and influencers. 3 Facts about Communication for Leaders. 1. Authenticity counts a lot. Be honest and sincere. Your behavior and actions communicate a world of information be clear on the messages you send when you aren’t speaking a word. Want to learn more? Gender Differences in Communication 4. Communication is the means by which ideas and information are spread from person to person. People use communication to express feelings, emotions, opinions and values, to learn and teach, and to improve their status. Communication is therefore vital to human interaction whether between parents and children, bosses and employees or even husband and wife. The diversity and characteristics of those involved in any interaction can thus affect communication. Taking account of any diversity in interaction rather than assuming uniformity is important to achieving Groups of working individuals are typically classified based on the colors of their collars worn at work; these can commonly reflect one’s occupation or sometimes gender. White-collar workers are named for the white-collar shirts that were fashionable among office workers in the early and mid-20th century. Blue-collar workers are referred to as such because in the early 20th century, they usually wore sturdy, inexpensive clothing that did not show dirt easily, such as blue denim or cambric shirts