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ICT as a tool for enhancing women's education opportunities: and new educational and professional opportunities for women in new technologies

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1 ICT as a tool for enhancing women's education opportunities; and new educational and professional opportunities for women in new technologies.

Gill Kirkup. Open University UK¹

1.1 Introduction

The principle, familiar from other technologies, that you don't have to be a mechanic to drive a car, can also be applied to Information and Communication Technologies (ICTs). Gone are the days when a computer user needed some knowledge of a programming language, or an understanding of the difference between CPU and ROM. On one hand this is good news for women. If women were allowed to drive a car after only we passed a course in car mechanics, many of us would be still standing at the roadside. And if only those who had passed a basic electronics course were allowed to use washing machines and microwave ovens, most domestic work in the developed world would be done by men. It is because women can now 'drive' computers without needing computer science qualifications that gives ICTs the potential to enhance women's education.

But, our lack of ICT skills is not praiseworthy. Feminist writers for many years have argued that if more women were engineers and scientists, we might live in a very different world (Rothschild 1982; Cockburn 1985). There is no apparent connection between the numbers of women data entry clerks or call-centre operators and the numbers of professional women designing computer hardware and software, and there is no obvious career path from one to the other (although we might like to argue that there should be). These two kinds of relationships with technology, and the knowledge and skills needed for each, are different. In structuring this paper I have tried to address separately the education and skills needed to enhance women's opportunities in ICT based employment and the area of the potential of ICTs to enhance educational opportunities for women in any subject. There are, I think particular disadvantages for women in conflating the two

The first part of the paper will focus on the particular issue of the educational and professional opportunities for women in ICT. The second part will deal with the much wider issue of how ICTs can be used to enhance women's educational opportunities at all levels - in all areas of skill, work and life - that new topic called flexible 'Life-Long Learning'. My aim has not been to make a list of recommendations for policy and practice. I think that is the task of the EGM. What I aim to do is map out the area, looking at the kinds of recommendations that have been made over a number of years, and suggesting the use of a dynamic theoretical framework for developing new and perhaps more effective recommendations. I am also aware that my own background and expertise means that while secure about the lessons I draw from the situation in the developed regions of world, I do not claim expertise about

¹ Gill Kirkup, Senior Lecturer in Educational Technology, Institute of Educational Technology, Open University, Walton Hall, Milton Keynes, MK7 6AA, Bucks., UK
email : g.e.kirkup@open.ac.uk

the developing areas of the world. I hope that colleagues from these regions can see both the commonalities and differences between what I describe and their own situations

1.2 What counts as a professional opportunity in ICT?

It is not obvious what we mean when we talk jobs and professions in ICT. Millar and Jagger (Millar and Jagger 2001), in a large international study, use combined standard occupational classification systems to come up with a list of ICT occupations that includes:

computer systems and data process managers, operations and systems researchers and engineers, computer science teachers, computer analysts, programmers, software engineers, computer engineers, computer operators, electrical/electronic engineers, and technicians, radio, TV and video engineers, telephone installers, repairers and operators.

They also report that the ICT sector is now creating new jobs at an increasing rate: occupations such as Internet architects, and webmasters, and learning resources managers. All of which need core ICT skills. However most ICT related jobs are not in ICT sectors of industry, sales and marketing are the location of the greatest number of ICT related jobs (Cisco and Texas 2001)² There is commonly held belief that the demand for these skills in both the developed and developing world is growing faster than supply. History demonstrates that when this is the case in any arena of work, support for the inclusion of women as a reserve army of labour (Breughel 1979) grows, but not necessarily with the best interests of women at heart.

1.3 What is women's participation in ICT occupations?

In a review of five countries (UK, USA, Canada, Ireland, Taiwan and Spain) Millar and Jagger found the following common patterns of women's employment in ICT occupations:

- Women are severely under-represented in ICT occupations and their *participation has been declining*.
- Women in ICT occupations generally have *lower status* and in the UK and USA are *paid less* than men, and the pay differential increases with occupational status.
- In some countries women in ICT jobs are *better educated* than men.
- Where there is *part-time* work women are better represented.
- There are smaller proportions of women in ICT jobs in the ICT sector than in ICT jobs outside it. In the UK for example the majority of women classified as in ICT jobs are in low skilled, non-professional occupations with limited career opportunities such as sales or assembly line jobs. Women are particularly rare in engineering related ICT work.
- Most graduates at present in ICT jobs have *not graduated in an ICT -related subject*.
- Women in ICT jobs are on average *younger than men*.

This familiar pattern is of an occupation with a low proportion of female entrants, a significant 'leaking' (Alper 1993) of those who enter to other areas of employment and a ghetto of women in lower paid semi-skilled jobs (and as ICT work is globalised this

² <http://www.internetindicators.com/keyfindings.html>

pattern is distributed differentially across the world)(Carter and Kirkup 1990). This looks like a traditional pattern of vertical and horizontal work segregation. How did a new area of economic activity become gendered so quickly? (Spertus 1993) An obvious answer could be that men have seen it as a desirable area and women have not. This picture does not suggest that once inside ICT occupations women are held back because of their poorer qualifications and training.

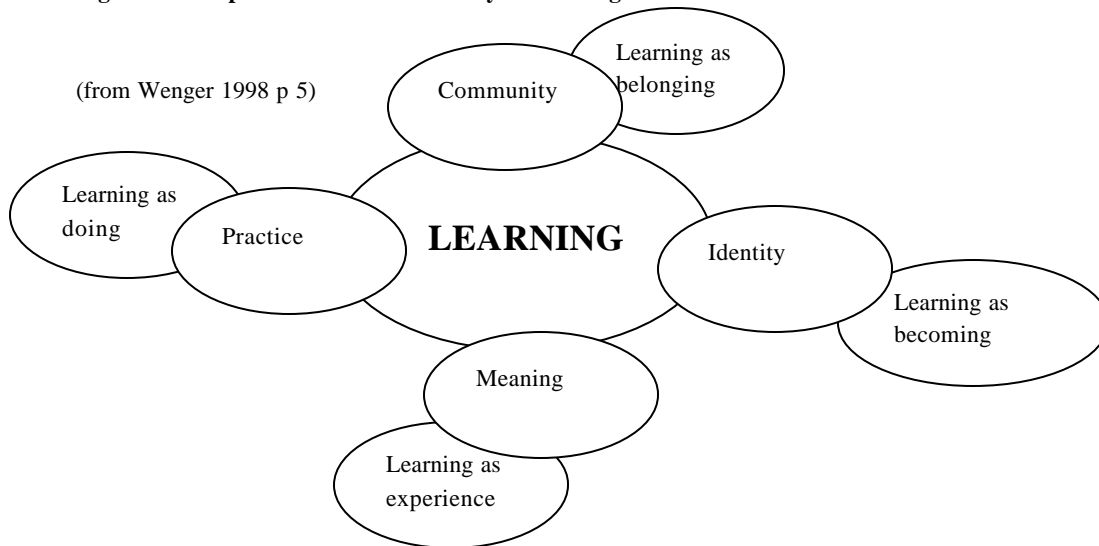
1.4 A Dynamic Model of Occupational Learning

In the last thirty years the amount of research on the gendering of employment and education is enormous. So are the numbers of recommendations coming from it. Unfortunately the results of initiatives to improve the participation of women and girls in technology education and work have *contributed* to the situation described above. This suggests the need for a coherent framework to understand the inter-relationships of various factors producing the present situation, to see why initiatives are not working.

A popular model of professional learning that I think provides a tool for understanding the gendered nature of ICT work, and an aid to the elaboration of integrated strategies is that of 'Communities of Practice' (Lave and Wenger 1991; Wenger 1999; Wenger, McDermott et al. 2002). A community of practice is simply a group/network of people engaged in a joint enterprise, interacting with each other and learning as they do so. What is produced is collective learning, and the development of practice. Not all communities are communities of practice, to be a community of practice members of community need to be mutually engaged in a joint enterprise, and using a shared repertoire of skills, discourses and artefacts. Learning happens as a product of this engagement, and so does the creation and performance of gendered identity. This learning may in most cases be informal, even implicit, but many organisations implement training to make needs and skills explicit. Interventions at the formal level may be difficult, but interventions at the informal level much more so.

Wenger's model of social learning involves four components (figure 1):

- Community (communities) to which the learner belongs, where the process of belonging is one of learning.
- Identity, which is a negotiated experience and one that Wenger describes as a trajectory, with a history and direction. It is produced through learning.
- Meaning, which is also an outcome of negotiation in the community. The community makes meaning and this comes out of the experience of its members as well as helping construct that experience.
- Practice, which is the engagement with a community in a joint enterprise or activity

Figure 1. Components of a social theory of learning

When new members enter a community they are in the position of what Lave and Wenger call 'legitimate peripheral participation'. As they engage with the community they learn, and align their identity and their practices with that of other community members. If learning is not taking place, if the new member becomes alienated from the community, if she leaks from the 'leaking pipeline' (ref.), the place to look for cause is not in any deficit of the individual, or in a particular learning event, but in the processes of the community. Why do some new members move from the periphery to the core - an ideal situation for professionals, and others stay at the periphery, others become not just peripheral but marginalised and eventually excluded? As new communities develop and expand, skills are shared and developed informally - for example in new ICT areas - members who are on the periphery learn what they need to move to the core - they are effectively sucked in by centripetal force to a core which needs populating. The force of this pull can be greater than the influence of gender. This was part of the story for women in the early years of ICT, and led to some over-optimistic predictions for ICT work as a non-gendered area. (Deakin 1984)

There is a rhetoric which suggests that new industries are both 'gender blind' (i.e. if you are good at your work you'll succeed whatever your gender) and that they value 'feminine' communication and 'people' skills. But recent research does not bear this out. A study of a new high tech ICT company (Woodfield 2000) employing highly qualified graduates showed that men were promoted and given management responsibility despite an acknowledgement by the company that they had poor management skills. And there was an unwillingness to give responsibilities to similarly qualified women who were acknowledged to have these skills. It seems that gender is re-asserted and jobs acquire gender quite quickly in some communities of practice.

1.5 A Dynamic Model of Gender

In applying 'gender' as an analytical concept to a problem, it is useful to review the term. Harding's model (Harding 1991) provides a useful framework with which to understand the different kinds of interaction between women, men and ICTs. Harding describes four aspects to gender. At its most simplistic gender is a property of individuals, described in some feminist literature as what society makes out of sex. This is the ground of our gendered subjectivities, which are developed in the context of the following other three aspects of gender. Gender is also a relation between groups, a property of material structures. This is exemplified in the gendered workplace. But other aspects of gender also operate here. Gender is also a property of symbolic systems, where representational systems, language and imagery are gendered. This is the aspect that produces the language of programming, digitised pornography and Lara Croft. This along with our subjectivities produces identity, and all those complexities of online identity produced by ICTs. Gender is also a way of distributing scarce resources, in the work environment and the educational environment. There are few situations where gender is used explicitly as an argument for allocating resources, but often indirectly gender is an influence. For example many more boy children across the world are bought expensive items (such as computers) than their sisters, and women running small enterprises in the new economy find it more difficult to get financial backing.

All aspects of gender operate in both formal and informal education and any recommendations to address the inequalities it produces must have a view across them all. The problem with work/skills identified as technological is that in most areas of the world these activities are part of what *constitute masculinity* (Cockburn 1983). In saying this I am saying something stronger than that it is an activity *associated* with men. It is easier to change an activity with which you are simply *associated* than change your relationship with something that constitutes *a key aspect of your identity*. All the components in Wenger's model (fig 1) are also dynamically involved with gender. This would be a depressing picture if the model of learning was static. But all learning involves change, and small changes in one part of a complex system can bring about large changes in another place (the butterfly wings metaphor). There is potential for changing the practices of gender.

1.6 Measures to address gender inequality in ICT related occupations?

There have been many years of initiatives to improve the participation and success of girls and women in ICT skills and work, but it is disappointing to see how limited the effect of these has been based on the kinds of surveys reviewed by Millar and Jagger. This has thrown more recent researchers back onto psychologically based explanations (Durnell and et al. 1995; Brosnan_M 1998; Clegg and Trayhurn 2000; Mitra, LaFrance et al. 2001), for example women's lack of confidence and interest in ICT, women's poor self efficacy, a lack of role models. I do not wish to suggest that these variables are of little concern but I want to place them in the wider context of social learning, and of ICT related skills as grounded in communities of practice with dynamic gender systems.

Reviewing the kinds of recommendations made in reports for improving women's participation in ICT work³, it is clear that they address different aspects of gender and if they were implemented they would make demands on a wide range of communities, formal and informal, employment and domestic, state and family. For example:

- **Change the image of ICT employment.** -The image is produced as part of the symbolic system of gender; it also reflects some truths about the nature of ICT work - long hours in some cases or the dedicated 'hacker'. This image is in many cases one that the community itself has colluded in producing, and many of those in it identify with it.
- **Identify pathways into specific ICT careers** - this suggests that women chose not to work in technology occupations because they do not understand how to enter this career. Many years ago Cockburn identified women's *refusal* to enter some areas of work rather than their non-participation through ignorance.
- **Create opportunities for skill conversion.** - This necessitates a community recognising both the existence of skills in women and the potential for the conversion of these to new ICT skills. This means being able to separate skills from gender.
- **Create multiple points of access to ICT literacy.** - The concept of ICT literacy has replaced that of skill, However the notion of ICT literacy may be more confusing than the notion of skill and could be contributing to the problem. It may be more useful to think more simply of ICTs as multipurpose tools, then concentrate on the task for which a tool is needed. Women are not averse to learning skills for tasks they need to do, or that they perceive as useful.
- **Create opportunities for career migration** - Women have embodied for many years the flexible career pattern, and portfolio career proposed now as the model for the new worker in the network society (Castells). This has not brought high status and financial reward; it is a main contributor to women remaining lower down the occupational hierarchy. Migration across and up is what women need rather than across and down which is the more general pattern.
- **Overcome barriers to entry** (though targeted selection recruitment and training). - This is one area where there has been a significant amount of success, because it is more amenable to formal mechanisms of control.
- **Enable progress and support retention inside jobs** - In an unsupportive community of practice a new participant may remain peripheral and even marginal and eventually 'leak' away. Mentoring schemes have been propounded in much of the equal opportunities and work literature since the 1980s. They are not unproblematic in particular in contexts especially when there are few senior women (Segerman-Peck 1991). It may be more appropriate to think of learning within the system rather than through specific one to one relationships, which often convert to a kind of pastoral counsellor rather than a sponsor and 'guru' as in the early literature (Kanter 1977)
- **Address issues of confidence and competence** (through professional support networks) - This suggestion recognises the importance of membership of a community not just for confidence but for skills development. It also recognises the fact that we are members of different, and overlapping, communities, some of

³ Although I have taken most of these recommendations from Millar and Jagger, I believe that they correspond well with similar ones made a variety of papers and reports during the last 20 years.

which provide resources, learning, and cultural capital that we transfer into work/professional activity.

- **Address problems of the work/life balance.** This is a major global issue the size of which is disguised by such a short recommendation. It should be understood as a core aspect of gender (i.e. men can only work such long unsocial hours because women, and/or domestic servants, carry the major domestic responsibility). And jobs in the new ICT sectors in particular have a record and an image of extremely long and unpredictable working hours: masculine work patterns and life styles. This is also an issue for Life Long Learning discussed later.

If these kinds of recommendations were either easy to implement, or struck at all the core problems of women's participation in ICTs then we would not be seeing in many countries the reduction, or at best, slow increase in the proportion of women working in ICTs. This EGM should be wary of producing grand but poorly theorised recommendations, more could be achieved with fewer well founded and well 'scoped' recommendations.

1.7 The Role of Formal Education in teaching ICT skills and knowledge

In the developed world formal education plays a key role in preparing people to enter communities of practice, and formal education itself can be seen as a particular kind of learning community. Interventions in this area have addressed girls' low participation since the 1980s.(Furger 1998)

1.7.1 At the school level

Learning ICT skills at school has been well researched in the developed world⁴ and too many good initiatives have been developed to be included here. The problem in developing countries is the enormous one of the naked classroom - the absence of the most basic resources. Much of the recommendations below will make little sense in such a situation. There is the same danger when thinking about schooling of treating problems as if they can be identified and dealt with separately. Formal school education is only part of a larger system where children learn to be gendered citizens and workers.

The problems of gender inequality in computer use in schools are well known. The AAU report 'Tech Savvy' ((AAUW) 2000) identified many issues, however it collapses the activities of using computers as tools in a variety of curriculum areas with specialist learning for computer science. To continue the driving analogy, the report makes no distinction between the skills needed to be a good driver and those need to be a mechanic or automotive engineer:

- **'Computer technology'**—Girls find programming classes tedious and dull, computer games too boring, redundant, and violent, and computer career options uninspiring.
- **'Electronic games'**—Girls have clear and strong ideas about what kinds of games they would design: games that feature simulation, strategy, and interaction. .

⁴ Brosan give a good review of English Language research carried out in schools in the 1980s and 1990s

- ***Transform pink software:*** Software does not need to be specifically designated for girls or boys. Software for both classroom and home should focus on the many design elements and themes that engage a broad range of learners, including both boys and girls, and students who don't identify with the "computer nerd" stereotype.
- ***Prepare tech-savvy teachers:*** Professional development for teachers needs to emphasize more than the use of the computer as a productivity tool. It must give teachers enough understanding of how computer technology works and its basic concepts so that they are empowered users.
- ***Educate girls to be designers, not just users:*** Educators and parents should help girls imagine themselves early in life as designers and producers of new technology. Engage girls in "tinkering" activities that can stimulate deeper interest in technology; provide opportunities for girls to express their technological imaginations.
- ***Create a family computer:*** Among other things, place computers in accessible home spaces. Think about shared or family-centered activities on the computer, rather than viewing its use as an individual or isolated activity.
- ***Set a new standard for gender equality:*** Equity in computer access, knowledge, and use—across all races, sexes, and classes—cannot be measured solely by how many people use e-mail, surf the Net, or perform basic functions on the computer. The new benchmark for gender equality should emphasize computer fluency: girls' mastery of analytical skills, computer concepts, and their ability to imagine innovative uses for technology across a range of problems and subjects.'

Again some of these recommendations are impossible to implement, and therefore bound to fail - for example asking parents to engage girls in 'tinkering' activities suggests an unlikely instant revolution in the gendered behaviour of families. It can seem that gender is being understood only at one level - that of individual behaviour, and not as the outcome of a network of deep and unconscious dynamic relationships. Some recommendations acknowledge role of the family as key to the production of gender and gender relations. But the suggestion to create a family computer seems to forget this. Any technology brought into the family will acquire gender, depending on its status as a family resource and whose activities it supports. These recommendations need to be grounded in the kind of multilayered model of gender described above. Recommendations also need to be realistic about the power of all the players in the communities involved - such as the commercial ICT industry. For example if boys play computer games most, then commercial providers produce what boys and their parents buy. This is simply a situation in which a product is designed with a proven market in mind and the market is gendered. The final recommendation again conflates the variety of ICT skills and could make things worse by not recognising the different skills girls have. If gender equality for car driving was measured by how well a driver exhibited the 'analytical skills' of driving and, 'automotive' concepts, and an ability to 'imagine innovative' uses for automobiles then we would be in danger of defining women's driving skills in terms of masculine mastery skills. There is similar danger with ICTs.

In the 1980s and 1990s interesting work was produced (Gilligan 1982; Belenky 1986) which looked at the different ways in which men and women came to think about the world: 'different ways of knowing'. This kind of work argued for the validation of diverse ways of thinking, rather than a hierarchy with a particular kind

of male intellectual tradition at the apex. Turkle (Turkle 1984; Turkle 1996) has done similar work on the ways people interact with computers. She sees computers as tools used as an extension of our identities, with significant differences in the ways that men and women use them to explore and perform their gendered identities. This is a subtle way of understanding the nature of our relationship with this technology, and the changes demanded of it, and of us, if we are to change the gendered nature of our present relationship to it. This understanding must be made in parallel with a materialist one, that an underlying driver for most ICT based initiatives in work, education, leisure, citizenship has at its core an economic force.

We must be clear that we differentiate between the opportunities for employment offered by ICTs, and tools they provide for educational and life skills. We must beware of the inappropriate application of ICT tools skill to a problem that would be better addressed in another way. As I write this paper a report appeared on research on the effectiveness of ICTs in schools as measured by student performance in maths, which suggests that for young children there was a *negative* relationship between classroom computer use and maths performance. One researcher, Angrist from MIT is quoted as saying about ICTs in the classroom: "*the costs are clear-cut and the benefits are murky.*" (*Economist* 2002)

Some of the ways in which we might achieve better performance from girls in schools would be to spend more on teachers and their training and lower class sizes. If we know that girls find computers less interesting than boys, putting more curriculum activity on them could produce a negative impact on other areas of the curriculum. It could be more effective to have more teacher involvement to encourage girls, help 'scaffold' their understanding and skills and support their appropriate engagement with ICTs.

1.7.2 At the Post-school level

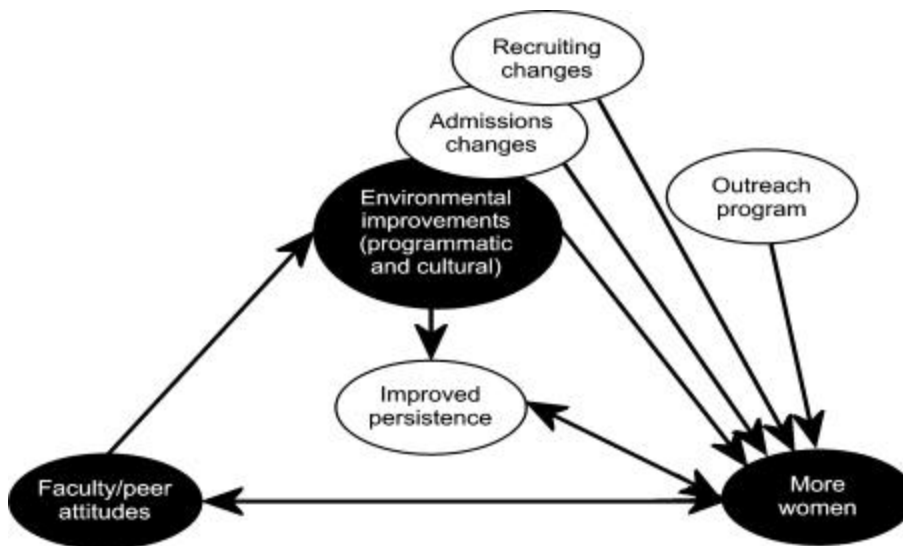
At the higher education level the emphasis in research and initiatives has been, unsurprisingly on the participation of women in specialist ICT courses, in particular computer science. The role of school is acknowledged and many initiatives have focussed on recruitment from there. These appear to have been more effective than changing the nature of computer science courses in universities. Margolis and Fisher (Margolis and Fisher 2002) in one of the most recent in depth studies of a high status US university computer science department found a large-drop out of women students following increased recruitment. They then looked at what they needed to do within the institution to retain these young women. Their model (Fig 2) could be enlarged to embed the department in a wider network of overlapping communities of practice: for example the wider university and the ICT industry where graduates may be heading.

Margolis and Fisher's recommendations include:

- **Changing the first year course curriculum** to give women students more hands on experience of computer use of various sorts and allow them to narrow their experience gap with men
- **Change the admission policy** to give less weight to experience

- **Put more effort into the human teaching.** Involve the most experienced teachers more with the women students in the early stages of their study.
- **Contextualize computer science** by creating more interdisciplinary courses.
- Make staff and students sensitive to the culture of a computing and adopt explicit measures to deal with alienation from this culture and valuing other kinds of culture
- **Adopt peer tutoring**
- **Support and initiate networking** among women staff and students.

Figure 2 Creating Change in Computer Science Departments from (Margolis and Fisher p 139)



The University environment, at this level, has much in common with the work environment, and therefore needs an understanding of the dynamic relations of gender, skill and knowledge as it operates in adult communities of practice.

1.8 Using ICTs to create learning communities and to support Life Long Learning for women.

1.8.1 The multiversity - the virtual university - e-learning

In 1963, Clark Kerr (Kerr 1963), the President of the University of California, coined the term '*multiversity*', to suggest that universities were no longer based on a body of universal knowledge or a heterogeneous body of students. This term has obtained a recent popularity⁵; its pre-digital ideals have been embraced by a number of digital learning providers. In a globalized world and a network society, the role of

⁵ Two examples of this: Alamo Community College 'Multiversity for Cyberlearning' at: <http://www.accd.edu/cyberlrn/>, and Multiversity Australasia: a packager of courses for delivery through other providers. <http://www.workingfutures.com.au/>. It is also worth noting that IBM called its online educational magazine Multiversity for some time. <http://www-1.ibm.com/industries/education/>

universities is challenged. Higher education, professional education and life skills education of various sorts is now being delivered by a range of universities, colleges and adult education institutions, and commercial providers. The distinctions between these are breaking down. This is not without irony for women. Just when we are having some success in getting equal access to higher education and professional education as students, researchers and teachers, and feminist perspectives are recognized as valid intellectual arguments; what constitutes higher level education and valid scholarly activity has been called into question through the creation of flexible learning and virtual universities. On the other hand women are often claimed to have the most to gain from these new flexible and distributed kinds of education.

1.8.2 Acknowledging the Third Shift

The banner headline of the home page of the Western Governor's University (a virtual university) reads (WGU, May 2002): *"See how one working mom was able to receive her degree without ever leaving her hometown"*. The woman featured is a high school teacher in a mid-West American community. Her own comment: *"I live a couple of hours away from any university, and didn't want to leave my kids at night"* is identical to statements made by many women open and distance learning students that my colleagues and I have interviewed over the years. However, this student equates flexible with 'virtual' and goes on to say: *"Pursuing a Master's degree was only possible for me online."*

Although online education provides new opportunities for women it is also the source of new pressures. The term Second Shift was defined in the 1980s to identify the work life balance of employed women. Women in paid employment did not substitute this for their domestic work; they carried out both obligations. Kramarae sees education in the new century as the Third Shift: *'As lifelong learning and knowledge become ever more important to economic well-being, women and men find they juggle no only the demands of work and family, but also the demands of further schooling and education throughout their lives.'* Page 3(Kramarae 2001)

Acknowledging the impact of this on the lives of women is not to resist it or advise women against engaging with it. Instead the focus of our recommendations might be on how to support women and alleviate the worse effects of this Third Shift.

1.8.3 Feminizing Online Education or Feminist uses for Online Education

ICTs -the Internet in particular - are seen as providing global access to information, people, intellectual tools, all those things which are key educational resources. However they are simply resources, in the same way that access to information is a useless resource if you don't have the skills to evaluate and use it. Shade (Shade 2002) distinguishes between the feminization of the Internet where women are targeted as commercial markets - as consumers rather than citizens or learners; and feminist uses of the Internet where women develop content, and networks that create opportunities for women in all areas of life. This issue of the role of women in creating the knowledge embodied in ICT networks is a key educational one. Formal education- learning communities- do not just transmit knowledge and skills they

create it, for centuries traditional universities have been key knowledge production organizations where women have only recently been allowed to participate.

Social learning theorists echo feminist writing about knowledge creation (Harding 1991; Haraway 1997) when they argue that it is from our own embodied experience that we use 'situated reasoning' to make meaning for ourselves and for others *Together, members construct and negotiate a shared meaning, bringing the process of the group along collectively rather than individually. In the process, they become ...a "community of interpretation" working towards a shared understanding of the matter under discussion.* (p (Brown and Duguid 2000)222).

Networked digital communications could allow women from across the world for the first time to engage with one another, their teachers and the content, across all sorts of boundaries of time and space. In a properly interactive virtual learning community, students should become members of the academic community of practice. Although it may be that much of what is commonly presented as virtual education does not allow any such interactivity and is simply digital publishing, where the teacher is an author and the students are readers. However, even where interactivity is possible, there are important gender issues around virtual communities. The task of all universities (*multiversities*) today is to find ways of including a much more diverse body of people in its knowledge making. But the fact that this has to be done through an electronic medium will not necessarily make it any easier than doing it in a face-to-face classroom. Communities (including the virtual) exclude as well as include, and because gender is not explicit does not mean that it is not operating, or that it has been transformed into something else.

1.8.4 Wired women

Digital media may also produce inflexibility for women engaged in learning. Research referred to earlier has shown that girls and women are less enthusiastic about using ICTs than men and boys. There is a danger that if ICTs are used to replace traditional media -simply because of an enthusiasm for them, or because the economic strategies of governments puts pressure on educators for their use, - rather than their use growing out of their proven value as educational tools, women in particular will be disadvantaged. Women's participation in traditional open and distance learning has sometimes been despite the barriers that technology has put in their way. A large scale survey of open and distance learning students in the 1980s (Kirkup and Prümmer 1997; Kirkup 2001) demonstrated differences in the preferred learning styles of men and women which made them respond differently to distributed learning methods. Women were uncomfortable with isolation and stated a desire for connection with others, at the time their preferred medium for this engagement was through face to face meeting. Engagement in creating and maintaining networks and relationships is often cited, as a reason why computer mediated communication will be a 'female' technology. Unfortunately, however, empirical work challenges this, and where activity can be measured men and boys seem to be more active in this area when the mediation tool is the computer than women and girls. Li (Li 2002) in a recent study of students at face-to-face universities in both the UK and China also found that the male students in both countries reported that they used e-mail more frequently, they spent more time online, and engaged in more varied activities than women students did.

There is now a wealth of research on the gender differences of male and female online activity, all of which demonstrate the online environment creating a gendered world operating in similar ways to the material world.

One thing that there has not been space to integrate into this paper is a discussion of the digital divide within women - both across regions and within regions. Castells (Castells 2000) notes that the global networked elite now have more in common with professionals in other countries than they have with the poor in their own cities, and this applies to women as much as to men. There are good reasons for keeping many of the learning methods and technologies that we have used in the past alongside new ICT based ones, many of them work very well. They are often attacked as simply being too expensive - but this depends, as the quote from Angrist suggests, on how you cost ICTs. An ICT only educational model is a deficit one, and it may be the one applied to the most disadvantaged groups

..despite concern about "have nots" lacking access to technology, there is a danger that technology will become the only access they have to experiences whose full value actually develops through complementary on- and off-line practices. People able to afford conventional campuses, which will continue to get comparatively more expensive, are likely to have the best of both worlds. Meanwhile the people who now commute on the old highways to commuter colleges may be pushed onto the digital highway but remain the same distance from the benefits of conventional campuses as before' (, pp 226/7)(Brown and Duguid 2000)

1.9 Creating Strategies to grasp the opportunities of ICTs in education in a gendered world

I make no apologies for this paper being largely an analysis of the barriers we face in optimizing ICTs for women's education. The world is full techno-enthusiasts, governments keen to put even more money into ICT, and at the same time attack educators and education as the cause of economic ills

Any recommendations coming from the GEM should do the following:

- **Distinguish between the use of ICTs as general tools in education and specialist education in computer science and informatics**
- **Question present definitions and understandings of what constitutes mastery in ICTs since this will be conflated with aspects of masculinity**
- **Identify recommendations that accept gender as it is presently constructed and understand its limits**
- **Identify recommendations that challenge gender as it is presently constructed and understand what needs to be done to implement it.**

I hope that the theoretical perspectives I suggest earlier in the paper can provide useful frameworks for realistic and workable strategies and recommendations to be developed by the EGM.

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1.10 References

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