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DOMINANT OR DIFFERENT? GENDER ISSUES IN COMPUTER SUPPORTED LEARNING

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ABSTRACT

A significant increase in the use of computer supported learning (CSL) within schools and universities across the world gives rise to concern about gender-related differences in performance and interaction style in these environments. Research has shown that initial perceptions of CSL environments as democratic and offering equal opportunities to all students were flawed because interactions that take place through electronic channels lose none of the socio-cultural complexity or gender imbalance that exists within society. Much of the recent literature states that women are disadvantaged because of inferior levels of access and technology literacy and dominant male behavior. However, the assumption that difference implies disadvantage is challenged by evidence that variable factors such as professed confidence and apparently dominant interaction styles do not necessarily lead to better educational opportunity and performance. This paper contains a summary of gender-related issues identified by international research and academic practice together with supportive case study examples. The conclusion is that women often perform better than men despite the observable differences in interaction style. The issues addressed are:

- If inequality of access and technology literacy are assumed to be diminishing problems as recent studies suggest, what can CSL designers and teachers do ensure that interactions and activities offer equal opportunities to all student groups?
- Does the gender imbalance that research identifies in access to, behavior and performance in CMC and CSL environments mean women are disadvantaged or simply that their use patterns and interaction styles are different?
- If research has identified gender typical orientations in learner performance online, is there any impact on perceived identity and behavior where the visual cues inherent in face to face interactions are missing and other signals form the basis of impressions and opinions?
- How far do gender imbalances in CSL reflect the values and norms of the culture they exist within and how far do they generalize across national and social boundaries?
- The paper concludes with questions for further research and suggestions about how instructional designers might increase the flexibility of courses to offer more equal opportunities to all students.

KEYWORDS: Learning effectiveness, Gender

I. INTRODUCTION

Gender based differences in performance and interaction style in computer supported learning (CSL) environments are recognized as an important focus for research [1, 2, 3]. There are however, conflicting views about the nature and impact of these differences. For example, the American Association of University Women Educational Foundation reports that girls perform less well than boys in science and technology subjects [4]. To the contrary, Kleinfield [5] notes that girls consistently score higher grades at school in virtually every subject, and that young women enter and graduate from college more frequently than young men. Citations from these respective sources illustrate the point of conflict:

“Girls are under-represented and lower achievers in math, science and technology subjects”

and

“Girls get higher grades, do better in standard tests and go on to achieve higher qualifications in virtually every subject”

Since both these sources appear to be well supported by research, it must be concluded that questions about whether some student groups are in fact disadvantaged by limited access and technology literacy remain open to discussion. The question raised by Kleinfield is whether gaps that may have existed in the past are now closing.

Most early (circa 1990s) research in this area found that women and girls did have less opportunity and ability to succeed using technology for educational purposes. More recently it has been found that limited access and literacy are disappearing problems and that young male students are the most consistently low achievers with CSL. Evidence also demonstrates that theoretical conceptions of CSL environments as democratic and offering equal opportunities are flawed because social and educational interaction that takes place through electronic channels loses none of the socio-cultural complexity or gender imbalance that exists in more traditional learning environments [6]. It also seems that this imbalance may be largely culturally determined [7] so generalization may be an unrealistic proposition.

Research findings are consistent in identifying gender differences that exist in terms of interaction styles, approaches to, and uses of technology. However, the case presented here is that these differences do not support the common conception that women are educationally disadvantaged by this situation or that differences fall neatly on different sides of a gender divide. With new educational methods and the associated forms of interaction, we may also need to look for new ways of considering identity and concepts such as gender. One author suggests that:

“Conceiving of gender as under constant construction helps demystify and thus disrupt the binary system...” [8].

Our view is that universal definitions of gender risk oversimplification of highly complex and constantly shifting concepts that are influenced by many variables, e.g. social context, class, ethnicity, educational background and so on. Furthermore, there is a growing body of literature that identifies a significant shift in human interaction and behavior in online environments where visual cues and body language are absent from the equation, [9, 10]. Finally, the impact of culture on conceptions of gender and behavior is identified as a strong determining factor of both the existence and the nature of differences, [11]. The paper concludes with recommendations, derived from collective experience, for practical ways to design and maintain learning environments that meet the needs of students of both genders and all levels of maturity.

II. STUDY METHODOLOGY

Our study of gender issues in CSL grew out of observations and experience that did not match the published findings of contemporary research. An initial literature review was enhanced through the use of

computer-mediated communication to engage in discussions with researchers in different locations. Thus a principle researcher who moved from Scotland to New Zealand was able to engage in dialogue with authors in the US, UK and Australia about the nature of the situations they reported. Collaborative presentation of a “Gender Issues in CSL” panel discussion session at the annual conference of the Association of Learning Technology (ALT) in the UK in September 2001 followed. Membership of the panel was initially invited on a voluntary basis and participation confirmed because of active research interests in the focus area. For the discussion session, panel members presented a brief summary of their own experience and supporting research, then concluded with a question about a particular aspect of gender difference and the implications for learning design. These questions provided the focus for small group discussions that allowed all participants to contribute their opinions and experience then report back to the larger group. The case presented in this paper is a summary of the collective views of the presenters and all participants. We accept that this does not include all perspectives on the complex issues of gender and technology. What it does is summarize the research findings of several authors from different disciplines, professional and cultural environments. This includes a variety of converging backgrounds with respect to theories of gender and technology, including cognitive, developmental and experiential. The common interest we share is in the real business of working with students in technologically mediated learning environments and how these can be designed to offer the best possible opportunities to all.

III. ACCESS AND LITERACY ISSUES

Early CSL research found that women were disadvantaged by lower levels of computer literacy, access to technology and confidence in its use, and that girls were both under-represented and lower achievers in maths, science and technology subjects at school [3]. As well as these findings being open to challenge at the time [5], more recent studies suggest that access and literacy issues are a disappearing problem. It should therefore now be possible to examine differences that persist when these imbalances are removed.

A. A ten year survey of IT literacy at University entrance

Data have been gathered about general levels of computer literacy among entry level undergraduate students at the University of Edinburgh over the past ten years. The University is a large (around 16 thousand undergraduate students), elite and research-intensive university. While admission standards are demanding there is no reason to believe that selection fundamentally confounds the gender comparisons now described. The method of data collection is a brief, self-report questionnaire administered through the enrollment process. Although participation is voluntary, and responses are anonymous, an approach has been developed over the years that has made return of the completed questionnaires a convenient and natural part of the newly arriving students' experience [12]. Although the response rate was only 30% in 1990 (allowing the students to deposit their own forms) it was raised to 80% in 1991 by employing graduate students who reminded students, provided spare copies of the questionnaire, and generally encouraged them to respond. Response rates have varied around 60% to 80% over the years, influenced by organizational circumstances and the enthusiasm of our graduate assistants. The original reason for collection of this data was to assist the University in making decisions about the information technology support that would be required by its students, a purpose for which it has proved useful over the years. The data set now also represents a valuable longitudinal survey of computing experience and interest among this section of the UK population, although a degree of caution with interpretation is required because it is difficult to judge real levels of IT literacy through means other than direct tests of competence. Issues of access will be judged by respondents in terms of their perceived needs, and there may be some bias from a tendency to represent the “best” picture of one’s experience. Males and females may respond differently to these contextual cues as evidence presented in a later section of this paper suggests. Despite these notable limitations, the data do show a clear shift toward equity of access and expectation for female students over the years.

1. The early years

In the early years of the survey, gender was found to be a powerful predictor of the responses that students gave. In all areas of the questionnaire, gender differences were present and were highly significant. Women reported themselves as less likely to own computing equipment, believed themselves to be less experienced than their male colleagues in IT-related skills, and were generally less positive in the attitudes they expressed towards the importance and relevance of IT to their academic studies and future careers. In the early 1990s, some of these differences were clearly related to patterns of recruitment into the various faculties of the University, and the responses in some measure based on “genuine” differences in the relevance of IT to academic disciplines. For example, women were more likely to be joining the Faculties of Arts and Social Sciences than Science and Engineering. Rightly or wrongly, at that time skills in computing and IT were widely seen as being more relevant to the sciences than the humanities. Over the passage of the decade, the pattern of gender differences has changed in interesting ways, though it cannot be said that gender differences in the students’ responses have gone away. Again, it is important to remind the reader that these are self-reports rather than objective measures of competence. When students describe themselves as being “fairly confident” in their ability to use computers, this no doubt correlates with some genuine level of competence, but also says something about the students’ overall feelings of personal confidence. Studies cited in the later sections of this paper suggest that, given a situation of equivalent levels of ability, a group of men are likely to express higher levels of computer-related self efficacy than a group of women. Students were asked to comment on the prospect of having to work with IT as a routine part of their academic studies. A pattern of increasing confidence and enthusiasm over the years is recorded.

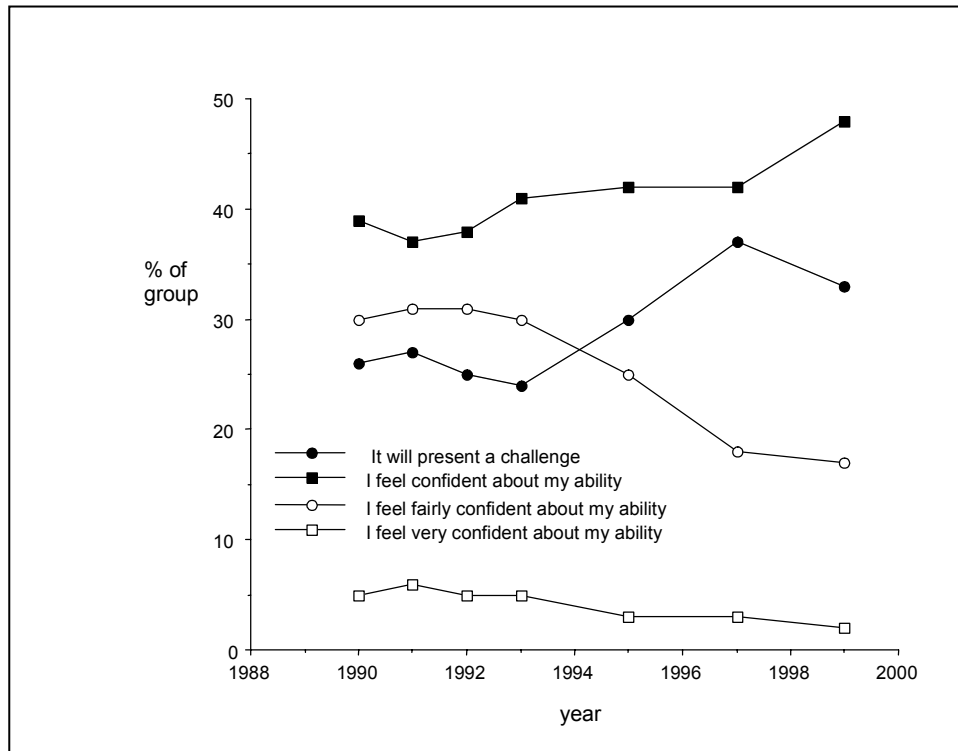


Figure 1: general feelings about the use of IT in university studies

A more objective measure would be responses to the questions about ownership of computers. Students were asked if they would have access to a computer where they lived, and whether this computer

belonged to them, or was shared with someone else. In the 1999 survey, women were still less likely than the men to own a computer. One assumption that we made, though with little evidence to support it, is that ownership of a personal computer may be driven, to some extent, by its use for playing games. Some research has shown that gaming is still more likely to be the preserve of men than women [13].

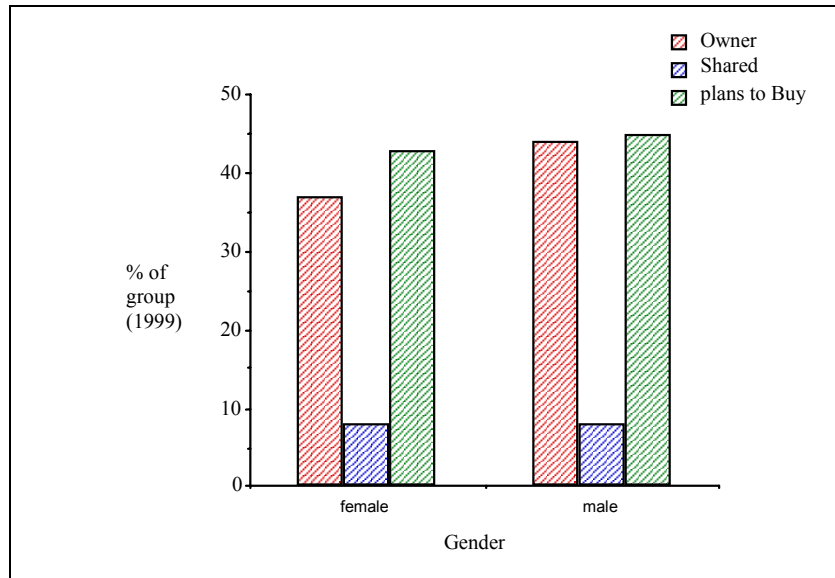


Figure 2: ownership of, access to, and plans to buy computing equipment for studies

The closing of the gender gap is notable with electronic mail and Web use. The proportional increase in those describing themselves as “very confident” is much greater among the women than among the men. Again, these changes may be understood partly in terms of the practical relevance of these technologies, as they have, over the period of study, become an integral part of courses in most discipline areas.

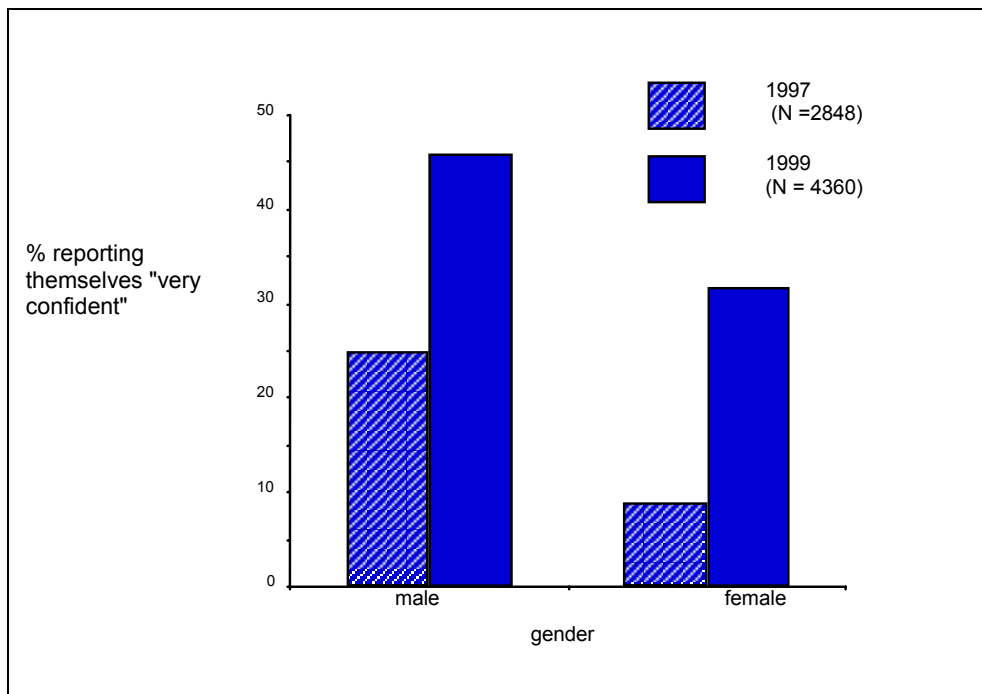


Figure 3: expressed confidence in the use of electronic mail*

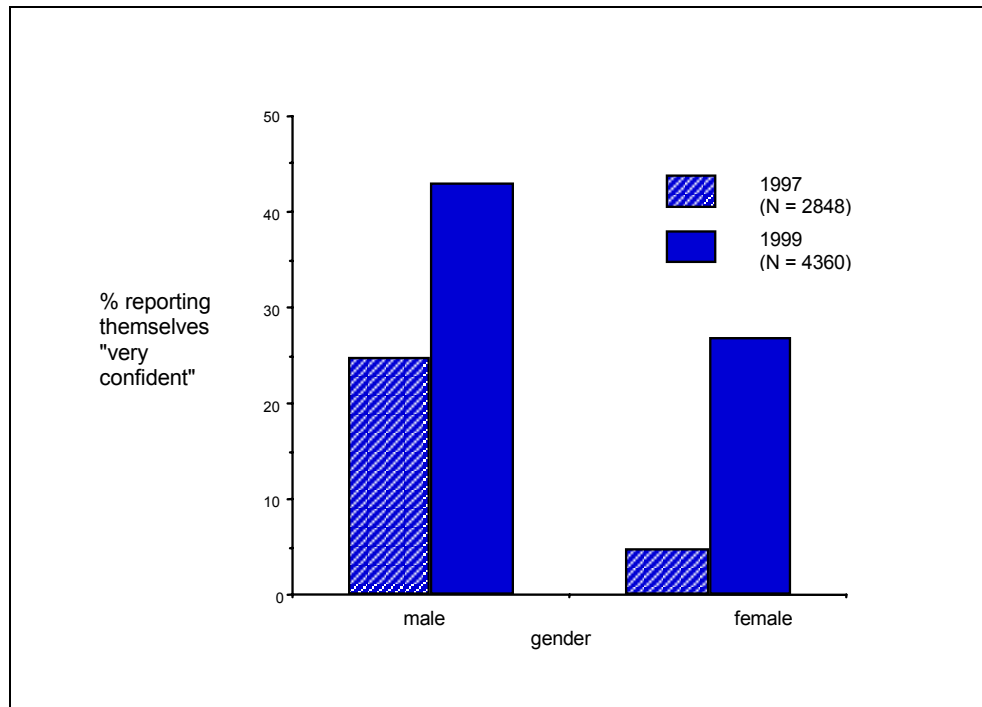


Figure 4: expressed confidence in the ability to browse the World Wide Web*

(* The significant variation in N between 1997 and 1999 reflects a merger with another institution in 1998)

The Web as a source of information, and electronic mail as a medium of communication, make these two emerging technologies increasingly practically relevant and interesting to women. It can be argued then, that women's expressed interests in and judgments about computers are becoming more positive as a result of the technology's increasing pragmatic significance. This point is summed up in a recent New York Times article on market research conducted by a computer games company. Although girls take a significantly different approach to such games despite all attempts to encourage them to do otherwise, according to the commercial and research sources cited in this article, they are no longer either reluctant or lesser users of technology.

“Grown-ups’ angst over the digital gender gap looks quaintly irrelevant now that teenage girls are addicted to instant messaging and the majority of Internet users in the States are female... Girls had no trouble adapting to computers once the machines did something that interested them.”
New York Times 5/8/2001 [47].

The most striking change in gender difference over time can be seen in the responses to two questions which have been asked, in identical form, since the early days of the survey. These are questions which ask the newly arriving undergraduates to speculate about the frequency with which they will be expected to make use of computing technologies, and the importance which these technologies will have for their studies. In the early 1990s these questions provoked marked and consistent differences in response between the men and the women. Over the decade these differences have gradually and completely disappeared. Notice that these questions call for objective judgements by the students about the importance and relevance of the technologies, rather than asking them to rate some aspect of their personal relationship with the technologies. These male and female students have reached a point of agreement about the salience of information technology in their work and study which augurs well for equity in applications of computers in teaching and learning.

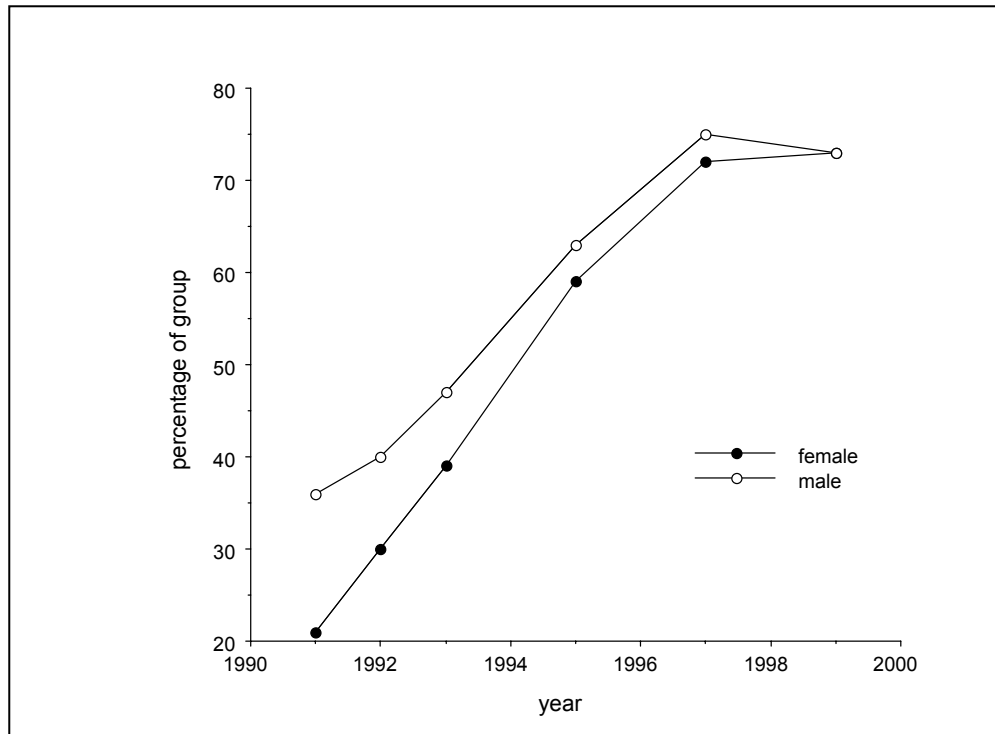


Figure 5; percentage of “important” or “vital” responses to the question “How important do you think that computers will be to your University studies?”

The assumption that gender based inequity in terms of access and computer literacy is a disappearing problem is borne out by the findings of this study along with research and reports from various sources across the western world. The discussion now turns to the differences that persist in this “more equitable” environment and possible interpretations of their impact.

IV. DISADVANTAGE OR JUST DIFFERENCE?

Once male and female students are more or less equal in terms of access, experience shows that gender based social relationships, interaction styles and inequities that exist in traditional learning situations correspond fairly closely to those found in CSL environments [1]. These evidence-based assumptions contradict more optimistic claims that technology is gender neutral and so provides a democratic and equal environment. As CSL and Virtual Learning Environments (VLEs) become commonplace, educational designers must learn from experience and ensure that interactions and activities offer equal opportunities to all students. Some practical suggestions for achieving this objective are discussed below.

A number of researchers have identified common differences in the behavior of male and female students in CSL environments [14-17]. These differences include self-reported levels of confidence in ability to work successfully with technology, use of support systems and styles and patterns of interaction.

Analysis of dialogue in computer-mediated communication (CMC) consistently reveals gender difference in styles of participation and contribution. Generally speaking, women talk less, contribute less frequently, do not receive positive feedback to their contributions and do not appeal to the same sources

of support [1, 18,17]. However, there is some debate over whether these issues constitute disadvantages or simply differences in interaction styles. There is ample evidence of behavior patterns that could be described as dominant in discussion areas [19], and a notable tendency for men to profess more confidence in their general capabilities in CSL environments than do women. However, there is no evidence whatsoever that this leads to better performance or improved learning outcomes. Indeed, some research has found the opposite to be true [2, 20].

A. Case Study: An IT Module

This case study involved a cohort of Information Technology (IT) undergraduates taking a first year module called 'Electronic Information Services' (EIS) at The Information Systems Institute at the University of Salford, England in 1999 (see Richardson and French, 2001 for a fuller report). Whilst the course materials were presented mainly online, students attended some lectures and had access to paper based materials. From a class of 140, 70% of the students were male.

At the time of this study, the module developers were aware of a growing gender gap in the UK context. Gender differences in attitudes to technology have long been recognised. Research reveals a decline in women taking IT subjects at tertiary level [21], and research reveals that the national IT industry is male orientated with women representing just 22% of those in the profession [22]. The claims that men have a monopoly on technology [23] and that women may even be excluded from its use by virtue of its design and function [24] are important issues to confront when using technology for learning. The researchers along with others [25], are concerned that these issues could lead to a situation where women in the UK may have little input into major new technological innovations. The point has been raised that recent initiatives designed to attract more women into IT and computer science professions have failed because, having gained the necessary skills and experience, women actually choose not to pursue careers in these areas [26]. Given this background, there was some concern that women might even 'shun' the use of computers in learning environments.

1. The Research Process

The study was carried out using formative and summative questionnaires to collect quantitative and qualitative data. A number of meetings with focus groups also took place. Further information was gleaned from the experiences of the lecturer and her notes kept in the form of a diary.

The research focused on gender differences in the following key areas:

- Flexibility and access: Did students find increased flexibility with online learning? Did they have access to computers at university and in the home so they could study at convenient times?
- Motivation: Were students motivated to use the online materials? Did they feel confident before, during and after participation in the module?
- Learning: What time of day did the students study? Was this affected by access to technology, social commitments or other factors?
- Support: Where did students get support? Did they use their peers, work together or individually, or contact the lecturer?
- Learning outcomes: Were there gender-based differences in achievement?

2. Flexibility and access

The results showed that all students appreciated the flexibility of the module and liked to be able to work at their own pace. All the students used the computers provided by the university and 74% of students

had access to computers in the home. However the female students reported that although they may have computers in their home they had more problems with access such as having to share the computer with other family members or friends. Forty nine percent of the female students reported they did not have priority access to the computer in the home, whereas none of the males reported this. One student reported that she used her partner's computer when he went to work, after 9pm in the evening. These findings about access may concur with the findings of Kirkup and Abbot, [27] whose female students regarded a computer in the home as a family resource. Their students did not regard studying as a reason to raise their priority for access. Maynard and Pearsall [28] found that women often have no specified study time or study area at home, unlike men, whose study needs were at the top of the domestic agenda. This is common to other studies and warrants further investigation with a future cohort of students.

3. Motivation

All students used a mix of online and paper based materials. Students were asked to comment on the following statement prior to taking the module "I am apprehensive about using the online material." Twenty nine percent of females strongly agreed with the statement, whereas only 8% of males did. From this data we can conclude that the males professed more confidence than the females. In further discussion males stated that they were very confident that they would enjoy using the online materials, several females stated they were apprehensive about using the materials and about their overall ability for the technical aspects of the course (designing web pages).

4. Approaches to Learning

Gender differences emerged in learning. The female students spent much more time preparing for the module. This could be because of their general lack of confidence we have already discussed. The times students studied at home were different according to gender. Most males reported mainly working between the hours of 4-8pm while the majority of women studied later in the evening, fitting study around other commitments such as family. Again our findings reiterate those of Maynard and Pearsall [28].

5. Support

Gender differences emerged in the support mechanisms utilized by students. Females mainly e-mailed the lecturer and friends while males reported contact with their peers at University as well. None of the females reported that they used this method of support and this raised the issue of whether this type of learning isolated female students. There is conflicting evidence on this subject. Some research has found that women, especially those with family commitments, embrace the flexibility in learning schedules and attendance requirements which online learning brings [29]. Parallel research has produced conflicting evidence suggesting that women are "social learners" and prefer traditional learning over the need to adapt to another imposed model such as online [27, 29]. The researchers in this case felt that this could be an important issue for further study.

6. Learning Outcomes

The confidence expressed by the males and the apprehension felt by many of the women was not substantially reflected in the grades they achieved. The males achieved slightly higher grades than the women as a whole on what might be deemed the more technical aspect of the module (designing web pages). Overall the women's marks were concentrated at the top end of the grades for all of the assessed coursework. The questionnaires were anonymous with this cohort, but interesting data for future analysis on this ongoing module would be to correlate the grades with the responses in the areas such as confidence.

B. Implications for learning with technology

From this research it can be concluded that the online learning experience may well be different for males

and females. Female students in this case study did not 'shun' the use of technology despite a number of barriers to their learning. These barriers include their own lack of confidence, the possibility of learning in isolation, less access to technology in the home and the way in which they also had to fit their study around domestic responsibilities.

To ensure equality in online learning we need to address these issues. First, we must find ways for female students to gain equal access to computers in the home if we are expecting them to learn in the home environment. Secondly, we need to ensure female learners are not isolated and look at providing support mechanisms to prevent this. Thirdly, we must find ways of instilling confidence in some of the female students so that they feel they can tackle this type of learning. This may not be as easy as it may appear. Initiatives being considered by some universities in the UK such as giving students computers to use whilst studying for their degrees may assist in this process. However as we suggested earlier in this paper, existing social structures regarding gender and technology will have to be broken to bring about these changes. The issues are complex and, as the other studies in this paper demonstrate, there is much conflicting evidence.

C. Confidence ≠ Success

Research conducted in a similar context in a New Zealand tertiary institution found that female students performed consistently better than males in online courses [20, 30]. Study of a first year course in Interactive Web Design over three years focused on the performance of students who opted to cover the entire course in classroom mode compared to those who chose to study partially or entirely online. Enrolments are 70-100 per semester with N=507 over the period of the study. The course structure and assessment have remained more or less the same over the period, involving:

- A balance of theory and practical exercises;
- Self-test quizzes;
- Access to readings, URLs and FAQs;
- Constant feedback from tutors;
- A research project requiring team collaboration and report preparation;
- A website development assignment and a final exam.

Knowledge of contemporary research findings together with the benefits of past experience provided the basis for initial assumptions that female students might perform better on the research assignment because it involved communication and teamwork, while males may do better on the technical task of website development. However, these assumptions proved to be unfounded as the female students performed consistently better than males on both tasks. Analysis of course entry questionnaires showed that females rated themselves less competent with Internet skills and experience at the outset, a situation that is reflected in the findings of other research [31]. Analysis of participation in online activities recorded by the course management system server then raised the possibility that male students may be over-confident in their ability and think they do not have to put in as much effort to meet the course requirements. This analysis revealed the following characteristics of male student behavior:

- Greater non-submission of a complete assignment
- Greater non-completion of all parts of each assignment
- Lower number of WebCT quiz attempts
- Lower course website page views

- Lower bulletin board participation

Average per semester	Female %	Male %
Quiz attempts		
No of quizzes attempted	11.4	7.4
Never attempted a quiz	4.0	20.0
Total page views	416.9	249.2
Bulletin Board Participation		
Posts read	38.5	16.2
Posts made	4.3	2.6

Table 1: Gender related behavior patterns in online learning, 1999-2001

Although these figures are relatively crude measures of cause and effect regarding performance levels, the tentative conclusion is that the course works well for women and mature students, while the younger male students appear to need more motivation and discipline than weekly classroom sessions currently provide. Motivational strategies now being introduced to address this issue reflect Bonk and others's [32] concept of increased dialogue and include:

- Weekly emails to the entire class to remind students what they should have accomplished and what they need to plan for, along with more general motivational content;
- Email reminders to those students who have not accessed the online course or not attempted any self-assessment quizzes;
- Increasing the dialogue through answering bulletin board and email inquiries promptly.

The reasons for better performance of women and mature students are believed to include stronger motivation to succeed, greater ability to work independently and to self-manage multi-tasking lives. These case specific findings are further supported by literature which reports opportunities for communication and participation in course related activities being enhanced for women when they do not have to enter 'inhospitable' environments such as computer labs [33]. Conole reports on a study involving 20 participants from four European countries participating in online neonatal training. The findings of this study concur with the one New Zealand one reported above in that females were more active in terms of use of the online materials and contributing to discussions. This contrasts with studies that suggest men talk and generally use the technology more than women do. In Conole's study:

- From of a total of 732 messages posted by participants 480 (66.8%) were from females and 243 (33.2%) from males;
- From a total of 1181 logins (59.1%) were females and 817 (40.9%) males. [34]

It seems then, that although a significant body of literature suggests that suitable educational models are currently not widely used to promote women friendly CSL environments, some situations are not particularly male friendly either. The challenge is to identify the characteristics that make learning environments friendly to both male and female students, and encourage participation and enhance opportunities of success for all. Before presenting the solutions offered during discussions at the ALT conference session, the concepts of gender, identity and culture are further explored.

V. GENDER, IDENTITY AND CULTURE IN CSL

As noted earlier in this paper, questions have begun to be asked as to whether fixed binary concepts of gender are in fact a useful basis for analysis of student behavior in CSL environments [8]. Bing and Bergvall suggest that the very questions being asked about gender differences perpetuate, even strengthen the male-female dichotomy [35]. While there clearly are a range of differences in learner behavior, some of which may be caused by, or simply coincide with gender, there is no compelling evidence to suggest that the objectives of educational systems are compromised by their suitability to one gender and not the other. Indeed, research has found that some gender performances conform to dualistic gender categories while other break out of these binary categories. These findings are further supported by investigations of online identity – another shifting concept – and its gender-related dimensions. In extreme cases, albeit in social rather than education situations, it has been noted that characters presented in online environments may bear little or no resemblance to the ‘real’ person. Some contemporary theorists would argue that every persona is as real as the ones constructed through the multi-sensory perceptions of others in face to face environments. While the general issue of cyber-identity is not explored in any depth here, it does challenge some common conceptions and has clear implications for gender relations in CSL environments. For further reading on this general topic, a range of case studies, essays and experience is presented in the book “Composing Cyberspace” [36].

In relation to CSL though, it is still sometimes claimed that gender can be masked in CMC because no visual cues are present [37]. However, the current literature identifies many cases where cross gender identity adoption has been revealed by the nature, style and language of contributions in CMC environments [38]. While gender may be relatively easy to recognize, other aspects of perceived identity are clearly affected when visual cues and face to face contact are absent [39] [9]. For example, rightly or wrongly, general appearance, styles of dressing, physical features and body language all tend to shape assumptions about person and personality. Study of these may be secondary with the focus on gender while their impact could be equally important. Behavior is also known to be affected in non face to face situations. For example, timid students may be willing to speak up more readily when they do not have to face the audience they are addressing and the intimidating aspects of asking questions may be overcome when a degree of perceived anonymity is introduced. There can also be an advantage to situations where all students are required to contribute to an online discussion as this ensures a voice for all and helps students to build confidence in their own opinions [40]. It also offers potential for exposure to multiple perspectives which is a valuable educational experience [41]. Although there is currently little published research on this topic, it is clearly one that warrants further investigation.

A. Cultural Impact on Gender Relations

A review of international literature (i.e. from the US, Europe and Australasia) on gender, identity and performance issues in online learning environments raises questions about how far the differences are culturally determined [7, 17]. Some variation may be attributable to the style of report or the nature of the gender imbalance in particular situations. However, it may also be the case that culturally based metaphors significantly influence perceptions of technology environments, their suitability or otherwise for different groups, the values they reflect and the behavior that is acceptable within their confines.

The term ‘cyberspace’ itself has some significance in a discussion of cultural influence on gender issues. The concept of cyberspace has its origins in the science fiction work, *Neuromancer*, published in 1984 [42]. Gibson’s cyberspace is a female region used and controlled by men, it is also highly sexualized. Women in this region are simply resources, bodies, they are not active agents or users of technology. So the very metaphor that is used to define the online environment that students now interact in has its roots in a very unequal society. Another popular metaphor for new technology is the ‘frontier.’ In US terms this evokes comparisons with the days of the pioneers on the great quest for the west [7]. While perceptions

may have moved on in the interim, the historical basis of these metaphors remains the same, and the ideals of that frontier have both positive and negative aspects:

- Positive ideals are self-determination, democracy, individual freedom, universal possibility and connectivity
- Negative aspects are selfishness, profiteering, lack of community responsibility, colonialism and violent conquest

In more real and contemporary cultures, there do appear to be differences that could be attributed to the socio-cultural contexts in which educational experiences are studied and reported. Many published studies from the US identify dominant and sometimes even deviant behavior among males [19, 38, 43, 44]. For example, Blum found that males talk more and interpreted this as controlling behavior, noted that they used different tones, ones of arrogance and certainty, and asked fewer questions which was taken to imply they had more knowledge. She concluded that interactions in CMC reflect those of F2F culture. Although the findings of this study could be interpreted quite differently and the methodology could be questioned because of the small sample used for a study that claims generalizable results, the fact that the author made the interpretations she did may say something about the environment she worked in. Herring also reported construction and maintenance of asymmetrical gender/power dynamics, exposed blatant double standards in freedom of speech 'rhetoric' in CMC environments, and concluded that the gender that controls technology benefits most strives to preserve traditional arrangements [44].

A notable exception from the US is research published by Pat Nolan from Texas Womens University [45], where CMC has enhanced educational potential across many disciplines and communities and seen women taking many firsts in Internet innovations and inventions. The question that may be asked from outside that context is why a separate university for women was established at all. Is this the only place they can be free from harassment by dominant male voices?

Moving to a different environment, Barrett & Lally present a case study from the UK in which male and female students played notably different roles:

- Males talk more
- Meta/cognitive content is the same for males and females
- Social content is higher for males
- Interaction is higher for females
- Only females had persistent access problems [17]

Although some of the findings are similar, this report does not draw conclusions about the situation as one in which women are at a disadvantage. Rather it seeks to explore what the meaning of these differences might be in terms of perceived friendliness of the environment and its impact on student performance. Moving on to the other cultural environments covered by this study, in Australia and New Zealand, requests for participation in this research from Australian academics resulted in expression of the opinion that "gender is simply not an issue worthy of attention in this country." In New Zealand, the only research available suggests that women are performing better than their male counterparts, although this may reflect a lack of investigation [40] and published research rather than a difference in what appears to be the norm elsewhere.

VI. SUMMARY OF DISCUSSION AND CONCLUSIONS

The general consensus from the research summaries and that reached by the discussion groups at the ALT

Conference was that the kind of differences noted by the presenters and supported by the research cited do exist in most western world educational environments. However, a range of interpretations of both the underlying causes and the effects of these differences is possible. The critical issue may be to develop universally applicable solutions such as those suggested by Margolis and Fisher [46] rather than conducting in depth research into the causes. In their recently published book, "Unlocking the Clubhouse: Women in Computing," practical solutions based on the authors' experience include:

- Improvement of the overall quality of teaching;
- A range of opportunities to improve IT literacy regardless of entry level skills;
- Focus on practical applications of computing in different disciplines;
- Establishment of support networks that allow women to form part of a critical mass.

In effect, what the researchers describe is a redefinition of the discourse of the discipline to make it more gender inclusive.

It was agreed that gender based access and computer literacy levels among student populations are disappearing problems, and that male and female users generally take different approaches to the use of technology, i.e. exploratory and developmental versus practical and instrumental. This inherent difference in approach leads to a debate as to whether some aspects of gender are in fact attributable to socio-cultural construction or to biological difference. No conclusion was reached on this issue though it was noted as worthy of further study.

It was also noted that women had, for a while, been encouraged to take up IT and Computing as professional interests, but that the nature of successful operation within these professions led to a subsequent decline in participation. The possibility for women that "we can, we don't want to" was also the subject of some discussion that reached no definite conclusion. Regardless of the outcome of these debates, the immediate implications for CSL designers are that they need to accommodate both instrumental and experimental approaches to the use of technology and to design learning environments that do not favour one over the other. This was considered to require a degree of flexibility that many learning environments currently do not include. For example, educational games and challenges may be more appealing to a typically competitive male orientation while communicative and collaborative activities may appeal more to typical female traits. The utility of these types of activities will depend to some extent on suitability to discipline and subject related learning objectives as well as gender related approaches and learning styles.

Another critical issue in respect to cross gender participation may be the levels and types of support provided for learners. For example, good moderation in a discussion forum can help to ensure equal participation. Inclusion of opportunities for self-assessment during a course can support self-monitoring of performance to ensure professed confidence is backed up by ability to achieve high levels of performance. Provision of a range of support options that are available without being asked for was considered to be another key factor. The issue of confidence was perceived to be a particular challenge for male students who were considered less likely to ask for assistance as well as less likely to recognize the need to participate in all course related activities and preparations for assessment. It was also recognized however, that in a context characterized by rapid change in so many areas such as technology, educational theories, learning environments, student demographics and professional requirements-- these issues are dynamic and in need of constant reappraisal. Issues of gender should not be treated in isolation from other factors such as learning styles, educational backgrounds and capabilities. A more general point was also

raised about CSL in its currently common form being predominantly designed to present didactic rather than constructive learning experiences and that this issue needs to be addressed along with design of environments that offer equal opportunities to all students.

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