Gender Imbalances in Computer Access Among Environmental Science Students

by

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Abstract

The survey of environmental science students at Charles Sturt University studying both in internal and external mode, has shown that the low socio-economic standing of women is carried through to the ownership and access to computers. The observed differences are very severe, clearly setting the women students at a disadvantage. These data seem to confirm the fear that the current economic imbalances between the genders will translate into imbalances in information access and information manipulation, thus resulting in ongoing, or even exacerbated inequity.

Introduction

A brave new world of communications on the information superhighway shows much promise of becoming the great leveller, allowing anybody with access to a server to develop a number of documents and to project a presence well beyond the local arena, to achieve truly global exposure. Brick and mortar infrastructure are a matter of the past, the bright future relying on information and style - as well as on the rapid turnover and replenishment of data.
But is the World Wide Web the great leveller, or are existing social and economic equalities merely ported to the new medium, without any levelling at all. Or, more disturbingly, are existing inequalities compounded and exacerbated by the need to own a WWW capable computer. Are we faced with the development of a class of information-rich citizens compared to a class of have-nots, "infoplebs" so to speak? And what about the implications for distance education developed on the WWW? As we prepare to develop distance education packages on the WWW we need to take such equity issues into consideration.

This paper addresses the gender representation on the WWW and the use of computers by the two genders: are there systematic differences or not? The observations are then contrasted with a population of internal and distance education students at Charles Sturt University.

**Gender imbalances on the internet**

There can be little doubt that there is a strong sense of anarchy on the World Wide Web. At present, the 'infobahn' is a free-for-all: everybody can publish web pages without spatial or social distinctions, as long access to a server is available. Despite this apparent anarchy on the web there is a clear domination by a small peer group of professional males. This issue is of concern to EEO professionals across the world (Ives 1995) as numerous studies have shown that computer ownership and computer use is predominantly male (cf. Spertus 1991, Shade 1993) and that the level of on-line access and use follows a similar pattern (Balka and Doucette 1994). This inequality on the web can be backed up by some examples:

A brief perusal of the *Electronic Proceedings of the Second World Wide Web Conference '94: Mosaic and the Web* held in October 1994 in Chicago (NCSA 1994) shows that, at rough count, of over 550 gender-identifiable author names 85% were those of men and only 15% were of women. Similar data were collected from the programs of the 1st WWW conference held in May 1994 in Geneva, the 3rd WWW conference held in April 1995 in Darmstadt and the Asia-Pacific WWW conference held in September 1995 in Sydney (table 1). The methodology employed is objective as it collected the totality of authors. The only bias encountered is that it tends to count multiple papers authored or c-authored by the same author as separate entries. However, it only identifies WWW researchers as opposed to authors of HTML pages or even users and thus tends to overemphasise the academic members of the WWW community.

These figures, however, correspond nicely with the observation by Strok (1992) that 13% of papers submitted to the journal *IEEE Expert* were written by women.

**Table 1 Gender of speakers and paper (co-)authors at World Wide Web Conferences. The category 'origin of speakers' refers to the predominant origin, ignoring exceptions**

<table>
<thead>
<tr>
<th>Sample</th>
<th>Date</th>
<th>Males</th>
<th>Females</th>
<th>n</th>
<th>Origin of speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st WWW Conference</td>
<td>May '94</td>
<td>90%</td>
<td>10%</td>
<td>89</td>
<td>Europe, USA</td>
</tr>
<tr>
<td>2nd WWW Conference</td>
<td>Oct '94</td>
<td>85%</td>
<td>15%</td>
<td>550</td>
<td>USA</td>
</tr>
<tr>
<td>3rd WWW Conference</td>
<td>Apr '95</td>
<td>~86%</td>
<td>~14%</td>
<td>156</td>
<td>Europe, USA</td>
</tr>
<tr>
<td>AP WWW Conference</td>
<td>Sep '95</td>
<td>84%</td>
<td>16%</td>
<td>99</td>
<td>Australia, USA</td>
</tr>
</tbody>
</table>

A data set from Australia shows that of the 16,733 members of the Australian Computer Society, a professional body of information scientists and managers 17% were women (data pers. comm. Jim McKinnon 1995). This figure tallies well with the number of women speaking at the 1995 AP WWW Conference. However, that conference event allows us to compare the gender composition of the speakers/authors with that of the attendees. Of the registered 842 attendees 23% were women (*i.e.* had gender identifiable first names are titles). This represents a 7% increase over the number women publishing research about the WWW.
A different approach was taken by the global WWW user survey conducted by Mika Rissa & Co Oy during a 30 days period in December 1994 and January 1995. The survey conducted via forms over the Internet, found that of 547 self reporting answers, 10.2% were women (Rissa 1995). A survey by Turnpike Demographics (Volant 1994) found that in late 1994 10.9% of the internet users are female members (n=1,800). Another web based survey, the 1rst World Wide Web users survey (GVU Center 1994a) conducted in April 1994 did not assess gender issues, but the 2nd World Wide Web users survey (GVU Center 1994b), conducted in September 1994, found for the survey period that 10% of the users were women (n=3522).

A limited sample (n=66) German research run on the WWW using a self-reporting mechanism had 7.6% female respondents (Batinic 1995). The 3rd World WideWeb users survey conducted during April 1995 (GVU Center 1995) which found that:

- in the US 19.1% of the Prodigy on-line service were female and 78.8% male (n= 1,261)
- in the US 17.1% of the WWW users were female and 80.3% male (n=10,212)
- in Europe 7.2% of the WWW users were female and 91.6% male (n=3,460)

It is of significance to note that the 3rd WWW survey did not find any significant difference between the incomes of male and female respondents. As this runs contradictory to the socio-economic differential of the two genders also in the USA, some caution needs to be exerted. The low representation of women in the 3rd WWW survey, combined with the relatively high income would indicate that the sample of women respondents is not representative of the female computer user population, but that bias has occurred. One of the problems inherent in the 3rd WWW survey is that it relies on a self-reporting mechanism, which obviously preselects those interested in the survey. In addition, since the instrument resided on the web it is a good indicator of the web usage, but not of computer usage overall.

It is clear, however, that the percentage of self-reporting women has increased from the second to the third user survey. The third survey has also shown that there is considerable variation between Europe and the United States.

All of these data sets confirm each other, stating that the web use among women was about 10% in 1994 and about 15-19% in late 1995, membership/access growing a rate outpacing that of men.

The publishing house O'Reilly and Associates surveyed internet users in early 1995 (O'Reilly & Associates 1995). Of these, 34% were female and 66% were male (n=1,000). The methodology used random digit dialling, requiring 200,000 attempts and 32,000 screening interviews. Of these 32,000, 1,000 Internet users and 500 commercial on-line service users were identified and interviewed in depth. The data providers claim that "random sampling techniques were employed. The age profile of the O'Reilly study (O'Reilly & Associates 1995) as well as that of the 3rd WWW survey (GVU Center 1995) shows similar age distributions suggesting that the survey results are comparable, at least at a coarse-grained level (for raw data see file "Gender_SEIS_95a.html").

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A case study

The sample population

Cultural Resource Management (PKM 266) is a compulsory (core) subject in the parks management degree offered in Spring internal and external mode by the School of Environmental and Information Science, Faculty of Science and Agriculture.(Albury Campus). The Bachelor of Applied Science (Parks, Recreation and Heritage) has a high reputation in the industry and is the preferred degree for parks rangers and local government parks management staff. First preferences regularly far outstrip the available quota. CSU is the major service provider for Queensland's Department of Environment and Heritage, and official service provider for NSW National Parks and Wildlife Service. The parks management student population falls into two parts, those students studying in face-to-face mode at Albury campus, and those students studying in distance education mode.
The majority of the students have a science background and are primarily interested in the 'traditional' ranger tasks, such as wildlife, vegetation and parkland management. This holds especially true for the school leavers (internal students) who have not yet been exposed to the realities of the work force requirements. The male to female students ratio is close to 1:1 in the internal student population of the core subject PKM 266, but more than 2:1 in the external population. Similar observations have been made for the 1993/94 population (Spennemann in press).

The average age of the external students is 30.45 ± 7.09 (n=64), while that of the internal students is 20.92 ± 3.07 (n=55). Among external students the women tend to be 5 years younger than the males, compared to an age difference of only a year among internal students.

**The questionnaire**

One of the problems inherent in many surveys of student's attitudes to computers and to computer-assisted learning is that they rely on information studies students as a sample. But it can be expected that information sciences students will possess a positive attitude towards computers, that they exhibit a predisposition to technology and hence represent a biased sample.

The questionnaire was handed out to all internal students by hand and placed into all staff mailboxes. Missing responses were followed by up by gentle reminders. The questionnaires were mailed to the external students. A fair number were returned soon after, while some were included with the first assignment. The outstanding questionnaires were resolicited at residential school. All these measures led to the following total return rates:

- staff: 88%.
- internal students: 97%.
- external students: 80%.

As the university provides staff with world wide web capable computers or access to such machines, the staff data have been excluded from the analysis on computer access.

**Ownership of computers**

The general level of computer ownership (table 1) shows that among the internal students 47% of all male students do not own a computer, while the same is true for 58% of the female students. Among the external student population only 27% of the male, but 50% of the female students do not own a computer. It is clear that the level of computer ownership reflects the socio-economic differential between men and women. As has been documented at length, women tend to occupy professions which have a lower standing in society - and a lower remuneration for the services rendered. Even where equivalent jobs are held, women tend to earn less. As the result of these factors the pre-tax average income of Australian women in paid employment is $30,062.24 p.a., compared with $37,923.60 for the males, i.e. on average 79.3% of a male's income (McLennan 1995). With an average cost of $2,500 for 486-based machine, women do not have the disposable income to afford it even if they have the inclination.

*Table 1 Type of computers (by processor type) owned by the sample population*

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http://www.usq.edu.au/electpub/e-jist/docs/old/vol1no2/article2.htm
We have in hand some income data for the external student population collected during a survey of those attending residential school in 1995. That study found the annual income of the student population queried to be varied with no direct correlation between the age of students and their income group. A large number of students had an income under $15k. The greatest number of students have an income between $25k and $30k, followed by those earning between $35k and $40k. The income distribution is more skewed if we look at gender with the majority of female students belonging to the low income group (Spennemann 1995).

However, the issue is not limited to mere ownership of the computer. Indeed, the type of processor in the machine and its clock-speed determines whether a machine is capable of running multi-media packages delivered over the WWW in a satisfactory fashion. To assess the implications, all machines were reclassified into those being 386-equivalent or slower and those 486-equivalent or better (table 2). Even though 386 based machines are capable of running WWW browsers the do so at a very slow speed. As the operating systems grow in needs of RAM, the web browsers become more powerful and by implication unfortunately also more demanding w.r.t. RAM. This, then, leads to these machines becoming even more unsuitable.

Table 2 Suitability of the computers owned by the sample population for use with multimedia applications

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EXT</td>
<td>INT</td>
</tr>
<tr>
<td>CPM</td>
<td>0.00</td>
<td>3.70</td>
</tr>
<tr>
<td>086/68000/Amiga</td>
<td>4.44</td>
<td>7.41</td>
</tr>
<tr>
<td>286/69020</td>
<td>6.67</td>
<td>3.70</td>
</tr>
<tr>
<td>386/68030</td>
<td>13.33</td>
<td>14.81</td>
</tr>
<tr>
<td>486/68040</td>
<td>46.67</td>
<td>29.63</td>
</tr>
<tr>
<td>Pentium/PowerMac</td>
<td>2.22</td>
<td>0.00</td>
</tr>
<tr>
<td>Unix</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>none</td>
<td>26.67</td>
<td>40.74</td>
</tr>
<tr>
<td>Total (n)</td>
<td>100.00</td>
<td>100.00</td>
</tr>
<tr>
<td>Total (%)</td>
<td>45</td>
<td>27</td>
</tr>
</tbody>
</table>

At this level, then, gender imbalances are exacerbated. Among the internal students 29.6% of the male, but only 7.3% of the female students possess WWW capable computers. Among the external students the percentage of WWW capable machines is much higher among males (48.6%), but even lower among females (6.3%). This differential between the two genders appears to have been caused by the fact that women own computers which have been handed down from their partners or from their parents (in the case of the younger, internal students).

As the slower speed of the machines implies longer connect times to servers and thus higher communications...
charges will result. These higher charges are born by members of the community who are economically weak and thus less likely to afford it. Thus the reliance on 386 machines represents a double penalty.

It is of significance to note that the ownership of WWW capable machines among female students at CSU is less than half of the participation rate of women on the WWW.

Access to computers

The use of the World Wide Web, however, does not require the ownership of a computer, but merely access to use. Access being defined as the ability to use a computer for prolonged period of time but not necessarily at the student's choice of time. Of the student population queried, 4-6% stated that they do not have access to a computer at all (table 3). Of those having access, 75% of internal students mentioned that they had access to WWW capable machine. This should in fact be 100%, as these machines are installed in the computer centre available for free use. Among the external population 80% of the male students claimed access to such machines, compared to 52% of the female students. Among external students the gender imbalance remains large, even though not as blatant as when mere ownership is considered. Nevertheless, the reduced level of access among female students should give rise to concerns.

Table 3. Suitability of the computers accessible to the sample population for use with multimedia applications

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EXT INT</td>
<td>EXT INT</td>
</tr>
<tr>
<td>Multimedia incapable</td>
<td>13.33 20.83</td>
<td>41.18 25.00</td>
</tr>
<tr>
<td>Multimedia capable</td>
<td>75.56 75.00</td>
<td>52.94 75.00</td>
</tr>
<tr>
<td>Do not own a computer</td>
<td>6.67  4.17</td>
<td>5.88  0.00</td>
</tr>
<tr>
<td>Total (%)</td>
<td>100 100</td>
<td>100 100</td>
</tr>
<tr>
<td>Total (n)</td>
<td>45 24</td>
<td>17 24</td>
</tr>
</tbody>
</table>

For the majority of the internal students the access to this machine is at the University computer center, with over 32% of the males students claiming to have access to this type of machine at home (table 4). The majority of the external students claims access at home (50%), followed by machines at work (30%). By comparison, only 11% of the female students studying externally access machines at work, while 33% have access to them at home and another 33% at their relatives.

Table 4. Location of the most powerful machine accessible to the sample population

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EXT INT</td>
<td>EXT INT</td>
</tr>
<tr>
<td>none</td>
<td>4.35 0.00</td>
<td>5.56 * 0.00</td>
</tr>
<tr>
<td>at home</td>
<td>50.00 32.14</td>
<td>33.33 11.11</td>
</tr>
<tr>
<td>relatives</td>
<td>4.35 0.00</td>
<td>33.33 0.00</td>
</tr>
<tr>
<td>work</td>
<td>30.43 0.00</td>
<td>11.11 3.70</td>
</tr>
<tr>
<td>friends</td>
<td>0.00 7.14</td>
<td>0.00 7.14</td>
</tr>
<tr>
<td>university</td>
<td>2.17 57.14</td>
<td>11.11 85.19</td>
</tr>
<tr>
<td>no answer</td>
<td>6.52 3.57</td>
<td>5.56 0.00</td>
</tr>
<tr>
<td>Total (%)</td>
<td>100.00 100.00</td>
<td>100.00 100.00</td>
</tr>
<tr>
<td>Total (n)</td>
<td>46 28</td>
<td>18 27</td>
</tr>
</tbody>
</table>
* This figure is of concern as all internal students would have access to the computer center's machines.

It is posited that women use computers as tools rather than 'toys', are less interested in exploring the medium, less persistent in attempting to learn new technology and thus are in more need of computer training and support (Cunningham 1994, Ives 1995). To test the validity of this hypothesis for the CSU Environmental Science students, students were asked whether they enjoyed trying out new computer programs (table 5). The figures show up some interesting differences: whilst 71% (74%) of the male internal (external) students enjoyed trying out programs, only 63% (67%) of the female respondents claimed the same. While this is a more than 7% systematic difference between the two genders, it is not statistically significant at the 99% level. More remarkable is that among the internal population 18.5% of the women stated that the did not enjoy trying out programs, while none of the male students made the same assertion. The differences among the external population are not as marked. The expectation had been that if there would be significant difference between the two genders w.r.t. this issue, it would have been among the external students.

Table 5. Level of enjoyment derived from working with new computer programs

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EXT</td>
<td>INT</td>
</tr>
<tr>
<td>Do not enjoy trying out programs</td>
<td>8.70</td>
<td>0.00</td>
</tr>
<tr>
<td>Enjoy trying out programs</td>
<td>73.91</td>
<td>71.43</td>
</tr>
<tr>
<td>Have better things to do</td>
<td>13.04</td>
<td>25.00</td>
</tr>
<tr>
<td>No answer</td>
<td>4.35</td>
<td>3.57</td>
</tr>
<tr>
<td>Total (n)</td>
<td>46</td>
<td>28</td>
</tr>
</tbody>
</table>

The attitudes of women to computers are not uniform, however, and we need to abstain from oversimplification. For example, a study by Grangenett et al. (1992) found that women are more anticipatory of the use of multimedia for learning than men.

Conclusions

The survey of environmental science students at Charles Sturt University, studying both in internal and external mode, has shown that the socio-economic standing of women is carried through to the ownership and access to computers. The observed differences are very severe, clearly setting the women students at a disadvantage. These data seem to confirm the fear that the current economic imbalances between the genders will translate into imbalances in information access and information manipulation, thus resulting in ongoing, or even exacerbated inequity.

While it can be said that the younger generation of female students is much more likely to own a computer than the mature-aged group, their computers tend to be hand-me-down models of slower speed, unsuitable for extensive work on the WWW. I addition, this generation of Environmental Science Students appears to be less prepared to experiment with computer programs than the mature age female student population.

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WWW Conference, 3rd

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