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On- and off-campus computer usage in engineering education

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Abstract

Computers and information technology play an important role in engineering education at the School of Engineering and Technology, Deakin University, Australia. Experience has shown that there are significant demographic differences between on- and off-campus engineering student groups. It was thought that the differences in the student groups might also lead to differences in computer usage patterns between the groups. A survey on computer usage was undertaken to determine the computer usage patterns of students at the commencement of their studies. The survey revealed differences between on- and off-campus students in whether students indicated they were regular computer users (on-campus = 77.2%, off-campus = 94.7%), the average reported hours per week usage of computers (on-campus = 6.0 hours, off-campus = 23.3 hours), the reported source of computer access, whether students indicated they were regular users of e-mail (on-campus = 29.8%, off-campus = 73.7%), whether students indicated they were regular users of the World Wide Web (on-campus = 38.6%, off-campus = 68.4%), and the reported source of World Wide Web access. It is proposed that the differing personal circumstances of the two student groups may contribute to the difference in survey responses.
1. Introduction

Computers and information technology play an important role in engineering education at the School of Engineering and Technology, Deakin University, Australia. Hence it was considered important to understand the computer usage patterns of students at the commencement of their undergraduate engineering studies.

Experience has shown that there are significant demographic differences between on- and off-campus engineering student groups. It was thought that the differences in the student groups might also lead to differences in computer usage patterns between the groups. While on-campus students have access to well appointed computer laboratories, the level of computer access that off-campus students have was largely unknown. To address these questions a survey of commencing on- and off-campus undergraduate student computer usage in engineering education at Deakin University was undertaken.

2. Computers in engineering and technology education

Just as computer and communication technologies pervade many aspects of our lives, computers have many roles to play in education. These roles include not only classroom teaching and learning experiences, but also administration, teacher training, the planning and development of educational material and general communications.

When the ‘power’ of global networked communications is added to computer applications we have the Internet. The Internet offers a new range of educational
technologies to educators that includes: electronic mail, file transfers, the multimedia capability of the World Wide Web (WWW), low-cost, desktop videoconferencing, on-line, interactive tutorials, real-time group conferencing, remote access to laboratory experiments and 3D interactive modeling.

For engineering and technology education, computer applications can include computer programming, numerical analysis, computer simulation, computer aided design (CAD), computer aided manufacture (CAM), electronic communications, information retrieval and computer aided learning and assessment. The use of computers in education is particularly relevant to engineering education, as the computer has become one of the central tools of the practicing engineer, whether it be for CAD, project planning, process control, budgeting, data communications or software development.

3. Engineering and technology programs at Deakin University

The School of Engineering and Technology at Deakin University in Australia offers a three year Bachelor of Technology and a four year Bachelor of Engineering at the undergraduate level, and Masters and Doctoral engineering programs at the postgraduate level. All of these programs are available via flexible delivery mode. The programs are based on a model of flexible delivery systems (Briggs, 1995) that incorporates:

- a modular curriculum;
• a formal assessment system for recognition of prior learning (both academic and experiential) based on granting advanced standing in appropriate course modules;

• course modules developed in print form, supplemented by an array learning resources, including audio and video presentations, home experimental kits, computer aided learning packages, remote (Internet-based) laboratory experiments and conventional laboratory work requirements; and

• computer mediated communication systems, including e-mail, video conferencing, WWW-based bulletin boards and Internet-based conferencing.

A number of course modules go together to form a unit (subject). A full time student would normally study four units per semester, and eight units per year. A three year Bachelor of Technology is comprised of 24 units; a four year Bachelor of Engineering is comprised of 32 units. The undergraduate programs are delivered on-campus, full-time for conventional entry students who come directly from secondary school. Mature age students may study the programs off-campus and/or part-time. The use of computers is an integral part of all the engineering study programs.

Of the computer applications identified above as used in engineering and technology education, only computer aided assessment is not yet employed in the Deakin University engineering and technology programs. The university centrally supports and provides (on a CD-ROM) at no cost to students, application software for e-mail, computer conferencing, virus protection, bibliographic database management and access to on-line databases. On-campus students have access to computer labs where all required software has been installed. Where a software package is to be used in a study unit, a key selection criterion is the availability of a low-cost, student edition of
the package, so that purchase of the package can be made compulsory for off-campus students. This may involve negotiation with software suppliers for special student pricing, or for the ‘leasing’ of software that off-campus students must return at the end of the semester. A strategy for off-campus software provision that was used in the past, but is no longer employed, was the use of centrally hosted, text-based applications that were accessed via a terminal emulation program and the Internet. The requirement to be connected to the network to run the application, and the inherent limitations of a text-based interface have rendered this approach obsolete.

The aim is that off-campus students are not required to attend the campus to complete their studies that require the use of computer applications. Computer programming exercises are coded, compiled, run and debugged remotely by off-campus students. Program listings and evidence of program performance would typically be submitted for assessment. Similar requirements exist for numerical analysis and computer simulation exercises. CAD exercises require students to draft their drawings on their computer remotely and submit their drawing files on floppy disk. CAM exercises require students to develop and validate their machine control programs remotely and submit them on floppy disk so that actual parts can be machined in a flexible manufacturing cell. A recent development at Deakin University allows students to submit their CAM files via the Internet directly to a computer that controls the flexible manufacturing cell, and then watch live video, via the Internet, of their part being machined (Ferguson & Florance, 1999). The School of Engineering and Technology has also developed a number of special purpose computer aided learning (CAL) packages covering areas as diverse as taking measurements with a micrometer to understanding moral decision making.
4. Methodology

4.1 Participants

The sample student population chosen was the enrolment in the level one unit SEB121 – Fundamentals of Technology Management. SEB121 is common to all study programs in the School of Engineering and Technology, and is taken by most on- and off-campus students in the first semester of the first year of their studies. As a core, level one foundation unit, the student enrolment captures a diverse group of students who will eventually study in undergraduate technology courses leading to the award of a bachelor degree at professional engineer or engineering technologist level, in disciplines including manufacturing, mechatronics, environmental, civil, electrical, electronics and computronics. A questionnaire delivered to this student group should provide a comprehensive snapshot of the computer usage patterns of engineering and technology students at the commencement of their studies.

While engineering and technology students will be required to become proficient computer users, and in some cases computer programmers, during the course of their studies, the unit SEB121 itself is not computer intensive; students are required to wordprocess their written reports totaling approximately 3000 words, use a CAL package that leads them through a moral decision making framework, use a Web-based multiple choice quiz bank and access on-line information sources in the completion of their reports.
The questionnaire was administered at the commencement of the first study semester in 1998, the enrolment of SEB121 at this time included 104 on-campus students and 37 off-campus students. Class time in the very first class was set aside for on-campus students, and the questionnaire was mailed with a reply-paid envelope to all off-campus students at the commencement of the semester.

4.2 Questionnaire

The questionnaire included five sections, with questions addressing the following areas:

1. **General demographic information.** Age. Gender. Mode of study (on-campus/off-campus).

2. **Computer usage patterns.** Have you used a computer before? Do you use a computer regularly? What type of computer do you use? (PC/Mac/other). How many hours per week (on average) do you spend using a computer?

3. **Access to computers.** Do you have access to a computer? Who does the computer belong to? (you/your family/your employer/a friend/other).

4. **Internet usage.** Do you regularly use e-mail? Do you use your own e-mail account? Do you regularly use the World Wide Web? Have you ever created a Web page? Do you have access to the Internet? Where do you have access? (home/work/school/university/other).
5. Other general, descriptive questions relating to computer usage. What do you think computers are most useful for? What task do you use computers for most? What computer program do you use the most?

5. Results

5.1 Response rate

From the total unit enrolment of 141 students a total of 76 questionnaire returns were received, giving an overall response rate 53.9%. The on-campus response rate was 54.8% (57 returns out of 104), and the off-campus response rate was 51.4% (19 returns out of 37).

5.2 Demographic information

The overall proportion of female respondents was 22.4%, and the overall proportion of male respondents was 77.6%. The overall age range of respondents varied widely, with significantly different distributions between on-campus students (mean = 18.9 years, \( s = 2.3 \)) and off-campus students (mean = 31.9 years, \( s = 8.7 \)). See section 6.2 for a detailed discussion of these results.

5.3 Computer usage
Table 1 gives the percentage of respondents who indicated they had used a computer before, and the percentage of respondents who indicated they use a computer regularly. For those respondents that indicated they used a computer regularly, Table 1 also gives the mean and standard deviation of the reported average hours per week computer usage. Of those respondents that indicated they used a computer regularly, overall, 91.8% of respondents indicated they used a PC and 8.2% indicated they used a Mac. For on-campus students who were regular computer users the response rate was 88.6% for PCs and 11.4% for Macs, for off-campus students it was 100% for PCs.

Table 1
Reported computer usage for on- and off-campus students

<table>
<thead>
<tr>
<th></th>
<th>Overall</th>
<th>On-campus</th>
<th>Off-campus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior computer use</td>
<td>98.7 %</td>
<td>100.0 %</td>
<td>94.7 %</td>
</tr>
<tr>
<td>Use a computer regularly</td>
<td>81.6 %</td>
<td>77.2 %</td>
<td>94.7 %</td>
</tr>
<tr>
<td>Mean reported usage</td>
<td>10.6 hrs/week</td>
<td>6.0 hrs/week</td>
<td>23.3 hrs/week</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>13.3</td>
<td>7.8</td>
<td>16.4</td>
</tr>
</tbody>
</table>

5.4 Computer access

Overall, 96.0% of respondents indicated they had access to a computer. For on-campus students the response rate was 94.6%, for off-campus students it was 100%. Of those that indicated they had access to a computer, they were further asked to
indicate the source of their computer access. Figure 1 shows the indicated source of student computer access for on- and off-campus students.

![Source of computer access](image)

**Source of computer access**

Who does computer belong to?

- Family
- You
- Univ.
- Friend
- Employer

Study mode

- On-campus
- Off-campus

Proportion of respondents

0% 20% 40% 60% 80% 100%

5.5 Internet usage

Table 2 gives the percentage of respondents who indicated they use e-mail regularly. For those respondents that indicated they use e-mail regularly, Table 2 also gives the percentage of respondents that use their own e-mail account; the balance of regular e-mail users gain access using someone else’s e-mail account. Table 2 also gives the percentage of respondents who indicated that they use the WWW regularly, the percentage of respondents who indicated they had previously created a WWW page, and the percentage of respondents who indicated that they have access to the Internet/WWW.
Table 2
Reported Internet usage for on- and off-campus students

<table>
<thead>
<tr>
<th></th>
<th>Overall</th>
<th>On-campus</th>
<th>Off-campus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use e-mail regularly</td>
<td>40.8 %</td>
<td>29.8 %</td>
<td>73.7 %</td>
</tr>
<tr>
<td>Use own e-mail account</td>
<td>90.0 %</td>
<td>93.8 %</td>
<td>85.7 %</td>
</tr>
<tr>
<td>Use WWW regularly</td>
<td>46.1 %</td>
<td>38.6 %</td>
<td>68.4 %</td>
</tr>
<tr>
<td>Created a WWW page</td>
<td>10.5 %</td>
<td>8.8 %</td>
<td>15.8 %</td>
</tr>
<tr>
<td>Have access to the Internet</td>
<td>84.2 %</td>
<td>84.2 %</td>
<td>84.2 %</td>
</tr>
</tbody>
</table>

Of those that indicated they had access to the Internet/WWW, they were further asked to indicate the source of their access. Figure 2 shows the indicated source of Internet/WWW access for on- and off-campus students.

Fig. 2. Indicated source of student Internet access for on- and off-campus students.
5.6 Descriptive questions

As only the top three responses for each of the descriptive question are reported here, the on- and off-campus responses are separated so that the larger absolute number of on-campus responses does not swamp the off-campus responses.

In response to the question, ‘What do you think computers are most useful for?’, the three most frequent responses from on-campus students were, assignments (29), information (16) and saving time (5). For off-campus students the three most frequent responses were, word processing (4), communication (3) and information (3). In response to the question, ‘What task do you use computers for most?’ the three most frequent responses from on-campus students were, assignments (37), information (5) and work (3). For off-campus students the four most frequent responses were word processing (7), communication (3), information (3) and Internet (3). In response to the question, ‘What computer program do you use the most?’, the three most frequent responses from on-campus students were MS Word (20), MS Windows 95 (7) and MS Office (7). For off-campus students the three most frequent responses were MS Office (4), Netscape (4) and MS Word (3).

6. Discussion

6.1 Response rate
As is required by university research ethics procedures, completion of the questionnaire was anonymous and voluntary, yielding an overall response rate of 53.9%. Comparison of the main demographic characteristics suggests that the sample respondent group is not significantly different from the total class population. While age data on individual students is not accessible due to university research ethics procedures, the mean respondent age for both on-campus students (mean = 18.9 years, s = 2.3) and off-campus students (mean = 31.0 years, s = 8.7) is closely aligned to the result from a survey for a different purpose on the next commencing class for the same unit; on-campus (mean = 18.5, s = 2.1), off-campus (mean = 34.4, s = 7.2). Data on student gender is available, and the proportion of female respondents (22.4%) is not significantly different from the actual proportion of female students in the class population (16.7%) (t = -0.48, P > 0.63). Likewise, the proportion of on-campus (75.0%) and off-campus (25.0%) respondents is not significantly different from the distribution of study mode in the class population (on-campus = 81.4%, off-campus = 18.6%) (t = 1.04, P > 0.30).

6.2 Demographic information

The overall female student response rate was 22.4% (24.6% for on-campus students and 15.8% for off-campus students). The on-campus female response rate is somewhat higher than the estimated female participation rate in Australian engineering undergraduate studies of approximately 15% (extrapolated from (Roberts & Lewis, 1996)). This may be due to the presence of an ‘environmental engineering’ discipline study stream at Deakin University, which has shown to attract greater than average numbers of female students (Roberts & Lewis, 1996). The low proportion of
female students in engineering studies means that the absolute number of female respondents is relatively small, suggesting caution in inferences about sample characteristics based on gender.

The observed age distributions of on- and off-campus students are significantly different, on-campus mean age = 18.9 years and off-campus mean age = 31.9 years (t = -6.31, P < 0.00001). The observed differences are as expected. On-campus students in the Deakin University engineering program are principally those entering directly from secondary school with a nominal age of 18 years at the commencement of their studies (these ‘conventional entry’ students are not normally permitted to study in the off-campus mode until they reach 20 years of age). Off-campus students are principally mature age (defined as 20 years or older at the commencement of their studies (Briggs, 1995)), with a wide variation in age, previous studies and personal circumstances. It is their personal circumstances that lead to mature age students normally studying in the off-campus mode; many of these students live remotely from the University and/or have full-time employment and/or are returning to study to upgrade their qualifications to improve their career prospects and/or are participating in employer-sponsored study programs. It is proposed that the differences in personal circumstances between the on- and off-campus student groups lead to many of the observed differences between the groups in the questionnaire responses discussed below.

6.3 Computer usage
All on-campus students reported having used a computer previously, while only 5.3% of off-campus students indicated they had not used a computer before. This is perhaps an indicator of the high rate of penetration of computers into secondary schools, and into society in general.

Even though 100% of on-campus students reported prior use of a computer, only 77.2% designated themselves as regular computer users. This finding agrees with 78% of students reporting themselves as ‘confident’ computer users in an Australian, on-campus, undergraduate applied science course (Ash, 1996). All off-campus students who reported prior use of a computer also reported themselves as regular computer users (94.7%); this may arise from off-campus / mature age student computer usage being strongly associated with employment (there are other indicators of this below). The rates of reporting of being a regular computer user for on-campus students (77.2%) and off-campus students (94.7%) are significantly different (t = -2.32, P < 0.024).

Questions such as ‘Do you use a computer regularly?’ or ‘Do you regularly use e-mail’ are open to subjective interpretation by questionnaire respondents. What is considered a high level of computer usage by one student may be considered average or low by another student. A measure of confidence that students have responded to such questions on a rational basis can be found in the significant difference in reported average weekly hours of computer usage between the group of all students that identified themselves as regular computer users (mean = 13.21 hours per week) and the group that identified themselves as not using computers regularly (mean = 0.14 hours per week) (t = 7.16, P < 2 x 10^{-9}).
Of the 81.6% of all respondents who indicated they were regular computer users, the vast majority (91.8%) indicated the computer type they use to be a PC. 8.2% of on-campus students indicated they regularly use a Mac, while no off-campus students reported Mac usage. The reporting of Mac usage by younger students recently from secondary school may relate to the association of the Mac with education and home computer markets, while the domination of PC usage reported by off-campus students may relate to the association of the PC with the corporate computer market, particularly in the fields of engineering and technology. No respondent reported using a computer type other than a PC or a Mac.

While the average computer usage for off-campus students is almost four times that for on-campus students (t = -4.3, P < 0.0003), the variation in usage reported by both groups is wide. The mean value for on-campus students was 6.0 hours per week, the median reported value was 3.0 hours per week and the most commonly reported value was nil hours per week. The modal value for on-campus students suggests that many of this group are not initially enthusiastic users of computers, and will require induction in the use of computers and demonstration of the value of computers as a tool to assist in their academic work. The mean value for off-campus students was 23.3 hours per week, the median reported value was 20.0 hours per week and the most commonly reported value was 40 hours per week; the modal value here again suggesting a link between computer usage and the nominal working week for mature age students in full-time employment.

6.4 Computer access
Overall, a significant majority of students reported having access to a computer. The on-campus response rate was 94.6%, for off-campus students the response rate was 100%. A similar, high rate of student computer access (90% to 100%) was reported in the study identified previously (Ash, 1996). For on-campus students, a high level of both access to computers (94.6%) and previous use of computers (100%) does not correspond to an equally high level of regular usage of computers (77.2%). This finding agrees with a prior finding that even when college/university level students were provided with computer accounts and an incentive to use the computer (lecture notes, homework questions, handouts, etc delivered via e-mail), more than a quarter (27.3%) elected not to access the computer-based learning resources on offer (Zagorsky, 1997).

It is interesting to note that all students, both on- and off-campus are provided a computer account through Deakin University, and all on-campus students have access to a large number of both PC and Mac workstations in a number of laboratories, and yet, a small number of on-campus students (5.4%) believe that they do not have access to a computer. This perhaps represents the fact that at the commencement of their studies, some on-campus students are still orienting themselves to university life, and do not yet fully appreciate what resources are on offer to them. As suggested above, an induction program in computing for on-campus students could be beneficial. Another interpretation found in the literature is that some students do not necessarily view the physical presence of on-campus computer labs as equating to ‘having access to computers’. Althaus (1997) notes that students who do not have their own computing equipment must make special trips to computer labs and vie with
other students for access to computers. Interestingly, the same source quotes an engineering student explaining their lack of participation in a class computer exercise as follows, “I didn’t dislike it, it was just inconvenient for me. I am an engineering major, and spend 30-40 hours/week doing problem sets. I do not have a computer w/modem in my room, and I only go to the computer lab to solve problems or write programs.” (Althaus, 1997).

For those respondents indicating they had access to a computer, Figure 1 shows the differences in the source of that access between on- and off-campus students. Off-campus students are largely self-sufficient in computer access (84.2%), with a small proportion indicating their family or employer as their source of access. By comparison, nearly two thirds of on-campus students list either their family (44.2%) or university (19.2%) as the source of their computer access. The distributions of source of computer access are significantly different between on- and off-campus students ($\chi^2 = 18.24, P < 0.0012$). For on-campus students, combining family (44.2%) and self (30.8%) computer access sources gives an estimate of 75.0% of conventional entry students having access to a computer at home. This compares to the recently reported figure of 68.2% of students (in a large group of 16-19 year old students in the United Kingdom) having access to a computer at home (Selwyn, 1998).

Computer access at home has been linked to academic performance and attitude to information technology (Selwyn, 1998). If the indicated source of student computer access of ‘you’ and ‘your family’ are taken to indicate access to a computer at home, then indicated access to a computer at home is (not surprisingly) strongly associated with computer usage; 88.1% of regular computer users had access to a computer at
home, and 91.2% of those with access to a computer at home reported themselves as regular computer users. Comparing reported average hours per week computer usage against the reported source of computer access shows that (other than for those students who report their source of computer access as their employer), those with access to a computer at home are the highest non-occupational users of computers.

While it is recommended to students entering the undergraduate engineering programs at Deakin University that they have access to a computer, it has not been made a mandatory requirement for entry on the basis of equity and access; principally due to concerns that off-campus students may not necessarily have access to and/or be able to afford a computer. The results of this research project suggest that for the students who elect to undertake engineering studies, off-campus access to computers is not a significant issue.

6.5 Internet usage

The use of the Internet as an educational medium is expanding, with justifications ranging from institutional cost savings to enhanced student access to education (Manjourides, 1997). Two important Internet services for teaching and learning are the WWW (for the delivery of multimedia content) and e-mail (for basic electronic communication).

The regular use of e-mail was significantly different between the two student groups ($t = 3.72, P < 0.0008$); 29.8% of on-campus students reporting using e-mail regularly, for off-campus students the reported rate was 73.7%. The much higher usage rate for
off-campus students may be due to their adoption of electronic communication as a means of overcoming distance barriers to communication in their studies and/or their prior exposure to e-mail as a means of corporate communication. A majority of regular e-mail users have their own e-mail accounts, though 14.3% (2 out of 14) of regular, off-campus e-mail users report using someone else’s e-mail account. It is noted that only female off-campus students reported using someone else’s e-mail account, but the small sample size does not lend itself to drawing meaningful conclusions. It can be suggested that the use of e-mail lists or other mechanisms for the delivery of course-related information to on-campus students via e-mail is not likely to be very successful. Anecdotal experience in the School of Engineering and Technology at Deakin University suggests that while e-mail is not a reliable method for contacting on-campus students, it is used very effectively as a communication medium by a significant proportion of off-campus students.

Overall, slightly less than half of the respondents indicated that they were regular users of the WWW. As for e-mail usage, there was a significant difference between the reported regular usage of the WWW between on- (38.6%) and off-campus (68.4%) students (t = -2.39, P < 0.023). The difference in the use of the Internet may be related to the differences in the source of Internet access reported by the two student groups, as discussed below.

Only a relatively limited proportion of students reported previously creating a WWW page (on-campus = 8.8%, off-campus = 15.8%). This suggests that while overall approximately half of students may be regular users of the WWW, only a small
proportion have competence and experience with the technology (hypertext markup language) that underpins the WWW.

Both on- and off-campus students reported a high proportion of access to the WWW (84.2% for both groups), so it is not a lack of access that make on-campus students relatively low users of the WWW. Considering the reported proportion of regular use of the WWW above, it appears that while more than 80% of off-campus students with WWW access are regular users, only 46% of on-campus students with WWW access are regular users.

For those respondents indicating they had access to the WWW, Figure 2 shows the differences in the source of that access between on- and off-campus students. The distributions of source of WWW access are significantly different between on- and off-campus students ($\chi^2 = 18.74, P < 0.00031$), and this may explain the differing usage patterns. More than 80% of off-campus students have Internet access at home, making it potentially easier for them to access the Internet at a time of their choosing; though access from home would normally involve a cost to the student in access charges from a commercial Internet service provider. Conversely, only 27.7% of on-campus students reported Internet access at home; the majority of on-campus students reported that their place of access was the University. While the University provides on-campus students with free access to computer workstations and the Internet, this access is only available while the student is on-campus with free time between classes and other study activities. The lack of access to the Internet at a time and place of convenience to on-campus students may account for their lower reported rate of regular use of the Internet/WWW.
For this student population, it seems clear that off-campus students will be in the best position to benefit from the provision of Internet-based resources in teaching and learning. While computer-based resources can be of great benefit in enhancing the distance learning experience, all efforts need to be made to assist on-campus students to access and use such resources if they are to share in the benefits as well.

There are important considerations in the use of the Internet by students that go beyond mere access to computing facilities and the Internet. Even when everyone is ‘on-line’, not everyone may have the same type of connection. On-campus students may have the benefit of high speed, dedicated networking, whereas the only option for an off-campus student may be a dial-up modem line that does not support the data transfer rate required for high quality interactive multimedia programs (Ingram, 1996). Additionally, simply having the requisite computer resources doesn’t automatically grant access to the information super-highway. If one is unfamiliar with computers or the Internet, attempting to navigate this new medium can be frustrating and frightening. A survey of 158 postgraduate students, composed of roughly equal numbers of on- and off-campus students, reports that even though more than 90% of students had access to a computer, 75% of all students stated a need for training in the use of the Internet (Brogan, 1997).

6.6 Descriptive questions
As an adjunct to the quantitative data collected, qualitative data was collected in the form of open-ended responses from students, based on personal perceptions, to a series of descriptive questions relating to their computer usage.

Based on responses to the question, ‘What do you think computers are most useful for?’, both groups of students indicated that computers were a tool for written communication and a source of information.

The responses to the question, ‘What task do you use computers for most?’, were consistent with the previous question. On-campus students clearly identified the ‘electronic typewriter’ function of the computer in producing schoolwork. Off-campus students also identified word processing as their most used function, but they also identified the Internet as an important use of computers, agreeing with their reported regular usage of the Internet at almost twice the rate of on-campus students.

The responses to the final question, ‘What computer program do you use the most?’, were again consistent with the previous two questions. Wordprocessors and other office tools were reported highly by both groups. The use of the Internet by off-campus students was again signaled by their inclusion of an Internet browser in their list of most used computer programs.

A previously cited study identified that students were primarily using computers in their studies for word processing (Ash, 1996). Previous research indicates that game playing is a popular use of computers by students, particularly amongst younger students at home (Kirkman, 1993). However, in response to the descriptive questions
above, only one (out of 19) off-campus student indicated that they used computers for ‘play’, an only seven (out of 104) on-campus students indicated that they used computers for ‘entertainment’ or ‘games’.

6.7 Gender differences

There has been a significant, long-standing, wide-spread, but declining gender gap relating to computer usage and access to computers (particularly at home) reported in the literature on computers in education (Durndell & Thomson, 1997), (Dorman, 1998). While differences based on gender were observed in the overall response rate to questions about where students have access to computers and to the Internet, the differences were not large, and the relatively low representation of female students in engineering studies (approximately 15%) makes it difficult to draw robust statistical inferences. It could be proposed that the prerequisite studies in mathematics and science at secondary school level, that are generally required for entry into engineering studies at the higher education level, mean that students entering engineering studies, regardless of gender, may already have some affinity for science, technology and computers.

6.8 Concluding remarks

The survey was administered early in the first semester of the first year of the study programs of most of the participating students. Due to exposure to computers as both a learning tool and a tool of trade of the practicing engineer, it is expected that their computer usage habits will change significantly over the first year of their studies, and
indeed, over the duration of their study program. An understanding of the computer usage patterns of students entering engineering study programs is essential for the design of the course to provide undergraduate students with the appropriate computer skills that they require both to study and to practice. A follow-up survey is planned to seek a comparison between students at the commencement of their study programs and those nearer to the point of completion of their study program.
7. References


