

# On- and Off-Campus Engineering Student Usage of a Computer Conferencing System

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## Abstract

*This article reports on the introduction of a computer-conferencing component into a first-year study unit in technology management at Deakin University, Australia. It was found that significant variations in computer usage were correlated to student study mode, including source of computer access, source of Internet access, hours-per-week computer usage, regular use of e-mail, regular use of the Internet, number of times the conference was accessed, use of computers for games, and use of computers for learning. Other moderate differences were also noted. Following exposure to the computer conference, on-campus students were more likely to agree that computers could assist their learning, and off-campus students were less likely to agree that learning from computers would be better than classes/lectures. (Keywords: attitude toward computers, computer conferencing, computer usage, engineering education, off-campus students.)*

The uses of computer and communications technologies in teaching and learning are widespread and varied. 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. Although computers and information technology play an important role in engineering education at the School of Engineering and Technology, Deakin University, Australia, the application of modern, graphical, computer-conferencing systems is relatively new. This article reports on the introduction of a computer-conferencing component into a first-year study unit.

The engineering and technology programs at Deakin University cater to both on- and off-campus students, and, inherently, there are significant demographic differences between the two student groups. It was hypothesized that the differences in the two student groups would lead to differences in computer usage patterns between the groups. It was also hypothesized that the experience of using a computer-conferencing system would change the attitudes of students toward computers and learning. This article presents an investigation to test these hypotheses and the results obtained.

## COMPUTER CONFERENCING IN EDUCATION

Educational applications of computer conferencing have been reported for more than two decades (Berge, 1997; Zinn, 1976). Cifuentes, Murphy, Segur, & Kodali (1997) conclude from the literature that computer conferencing "fulfills an assortment of functions ... bulletin board, public tutorial, individual project, free-

flowing discussion, structured seminar, peer counseling, collective database, group product, community decision making, and intercommunity network"; it "provides an environment conducive to collaborative learning and teaching and equal opportunity for communication ... promotes self-direction by encouraging learner autonomy"; and it "is appropriate for virtual classroom discussions, group projects, keeping personal interaction journals, and socializing" (p. 178).

An asynchronous learning network (ALN) is defined as a teaching and learning environment located within a computer-managed communication system (Hiltz & Wellman, 1997): a "virtual classroom" (p. 46). Hiltz and Wellman further suggest:

ALNs consist of a set of group communication and work "spaces" and facilities constructed in software. ... A virtual classroom [referring to a trademarked name of the New Jersey Institute of Technology] is both an instrumental group—in which students and instructors want to accomplish goals—and a community—in which students exchange emotional support, information, and a sense of belonging. ALNs are best at enriching educational options when they serve as a way to create the feeling of a true "class." (p. 46)

A natural application of computer conferencing and ALNs is in the creation of a learning community for students studying off campus. Research by the U.K. Open University into their "tutorial support model," where computer conferencing was used to replace telephone, letter, and face-to-face communication, showed that "students value the interaction with other students, as much as interaction with the tutor. They find it valuable to compare notes with their peers, to chat about issues tangential to the course and to create the kind of community usually only found on campus" (Mason & Bacsich, 1998, p. 250).

The literature on computer conferencing provides guidance on the successful design and operation of these systems in an educational context. Cifuentes et al. (1997) identify six design criteria: "(a) grading system, (b) grouping, (c) collaboration, (d) relevance, (e) learner control, and (f) technological preparation" (p. 177).

Mason and Bacsich (1998) identify seven key issues: (1) structuring online interactions, (2) linking use with assignments, (3) limiting the asynchronicity of the medium, (4) enhancing the social environment, (5) training the tutors, (6) using the medium for feedback, and (7) implementing and supporting a conferencing system. Other design guides and frameworks are available: (1) understanding and establishment of student motivational incentives (Velayo & McKeachie, 1994), (2) enhancement of knowledge building and quality learning (Nuldén, 1997), and (3) strategies to engage students online and prevent "lurking" (Klemm, 1998).

## **COMPUTER CONFERENCING IN A TECHNOLOGY MANAGEMENT UNIT**

As part of both three-year bachelor of technology and four-year bachelor of engineering studies, students at Deakin University take a unit titled SEB121 Fundamentals of Technology Management in the first semester of the first year

of their studies. The commencing enrollment in this unit is approximately 180, and approximately one-third of these students study off-campus. The topics covered in SEB121 include the history of technology, its relevance to society, ethics and the professional responsibilities of engineers and technologists, library research skills, written and graphical communication, oral presentation, the concepts and basic principles of management, and the basic principles of quality.

It was decided to introduce and trial a computer-conferencing component into this unit for two principal purposes: (1) to increase the amount of tutorial-type activity for students, without incurring the same corresponding level of increase in staff resources that would be required for additional class-based tutorials, and (2) to facilitate some form of interaction between off-campus students who had traditionally been relatively isolated. Additional possible outcomes that were identified included: (1) increased student engagement with the course material, (2) additional experience for students in the use of computer and communications technology, (3) an opportunity for students to read and reflect on the thoughts and perspectives of their peers, and (4) possible interaction between on- and off-campus students, which previously had been virtually nonexistent, even though they study identical materials and take the same examinations.

The framework that was implemented for the computer-conferencing component included the following elements identified in Cifuentes et al. (1997):

1. *Grading*—Students were required to make a weekly contribution (for seven weeks) to the unit conference by posting their answer to one of three questions on current study topics posted by me each week. Student responses were graded weekly out of 2.0, in 0.5 increments, meaning a total of 14% of the total unit grade was available based on contribution to the conference.
2. *Grouping*—No grouping of students into subconferences was performed. In the initial trial, it was intended that students would not interact heavily on a peer-to-peer basis and that the volume of communication would not be excessive.
3. *Collaboration*—The requirement to submit answers to questions did not explicitly require collaboration on the part of the students, though there was an implicit understanding that they could read the contributions of other students in the development of their own contributions. Though I had read widely and sought advice from colleagues and invited observation of the trial while in progress, there was no collaboration in the implementation and operation of the conferencing system under trial.
4. *Relevance*—It was not expected that first-year, first-semester students would see the immediate relevance of the computer-conferencing process to their learning, but the attaching of marks to contribution was seen as a way of emphasizing the importance of participation. The content of the conferencing was made more relevant by selecting weekly questions that related directly to the topics being studied at that time.
5. *Learner control*—The most appropriate forms of learner control in computer conferencing are still the subject of debate (Cifuentes et al.). In this

trial, learner control extended only to the choice between which one of three weekly questions they would answer.

6. *Technological preparation*—Prior research has found a high level of computer proficiency and network access amongst students taking the class in question (Palmer, 2000). On-campus students were provided with a training session in a campus computer lab, and off-campus students were provided with printed instructions on how to access and use the system.

The framework that was implemented for the computer-conferencing component also included the following elements identified in Mason and Bacsich (1998):

1. *Structuring online interactions*—Conference structure is identified as important for achieving educational outcomes (Mason & Bacsich). Students were provided with a structure in the form of weekly subconferences that directly related to the corresponding themes of that week of the semester academic timetable.
2. *Linking use with assignments*—see 1.
3. *Limiting the asynchronicity of the medium*—The perceived benefit of the asynchronous nature of computer conferencing may, in fact, cause students difficulty in keeping pace with discussion threads and current topics (Mason & Bacsich). To direct the operation of the conference, the weekly question and subconference appeared just before the corresponding week of the semester, and students were encouraged to submit their contributions during that week; this encouragement included a reminder letter should they become tardy by more than two weeks.
4. *Enhancing the social environment*—For the first week, students were simply asked to introduce themselves. A separate, non-formal conference area was provided for informal and social communication between all conference members.
5. *Training the tutors*—No tutors, other than myself, were involved in managing the conference. I had previously attended training sessions in the operation of the conferencing system and participated as a “student” in an online professional development forum using the conferencing system.
6. *Using the medium for feedback*—The student participation in the conference was closely monitored, the weekly requirement for contribution permitted continuous assessment to be made and immediate feedback to be given to students. Students were also able to express their opinions about the exercise (positive and negative) publicly in the conference.
7. *Implementing and supporting a conferencing system*—All hardware and software infrastructure and required student software was provided centrally by the university, and all user documentation and system administration was provided by the author. Technical details of the system are documented below.

Other recommendations from the literature that were adopted included: (1) expectations with regard to computer conferencing clearly communicated (Velayo & McKeachie, 1994); (2) provide simple tasks initially to allow students to explore and practice (Velayo & McKeachie); (3) learner control over

submissions—students could edit, amend, and update their own previous submissions (Nuldén, 1997); (4) source referencing—the conferencing system allowed hyperlinking to external network references and resources from the Internet (Nuldén); (5) instructor-controlled submission—the conference administrator had the capability to moderate or censor conference content (Nuldén); and (6) computer platform independence (Nuldén)—PC and Mac conferencing client programs, as well as a World Wide Web (Web) interface, were available.

The conferencing system used was the FirstClass (1999) system from SoftArc; the use of the FirstClass system has been reported widely (Cifuentes et al. 1997; Vachris & Brendon, 1999; Weller & Hopgood, 1997). The FirstClass system is based on a client-server architecture; all messages are stored on the server, and student access to the conference is by means of a client program. A significant subset of the client program functionality is also available by using a Web browser; hence, most students could avoid installing any new, special purpose software on their computer, should they wish to.

## **HYPOTHESES**

Previous research into student computer usage in the unit SEB121 showed that significant variations in computer usage were correlated to student study mode, that is, on campus or off campus (Palmer, 2000). It was hypothesized that similar significant differences would be observed in the computer-conferencing trial (Hypothesis 1). Additionally, it was hypothesized that student attitudes to computers and learning would change following participation in a computer-conferencing exercise (Hypothesis 2). A study was undertaken to investigate these hypotheses.

## **METHODOLOGY**

Because all students would be required to participate in identical learning exercises, a pretest–posttest experimental methodology was employed. Students were surveyed during the first week of the academic semester and again during the last week of the academic semester. The initial survey was conducted before the introduction of the computer-conferencing activity, which commenced in week five of the academic semester. For on-campus students, the questionnaire was distributed and collected in class; for off-campus students, the questionnaire was delivered by postal mail at the appropriate times in the semester, including a reply-paid envelope so off-campus students could return their response at no cost. As required by university research ethics procedures, participation in the survey was anonymous and voluntary.

The initial survey sought information under the following categories: demographic information (age, gender, study mode), computer/Internet access, computer usage, and attitudes toward computers in education.

The end-of-semester survey sought information under the following categories: demographic information, computer usage, conferencing system usage, and attitudes to computers in education.

## RESULTS—START OF SEMESTER

### Response Rate

From the total commencing unit enrollment of 179, 122 questionnaires were returned, an overall response rate of 68.2%. The on-campus return rate was 79.1% (102 returns out of 129); the off-campus response rate was 40.0% (20 returns out of 50).

### Demographic Information

The overall proportion of female respondents was 13.1% (14.7% for on-campus students, 5.0% for off-campus students); the overall proportion of male respondents was 86.9% (85.3% on-campus, 95.0% off-campus). The age range of respondents varied widely (17 to 44 years), with an overall mean of 21.1 years and standard deviation of 6.8 (on-campus  $M = 18.5$  years,  $SD = 2.1$ ; off-campus  $M = 34.4$  years,  $SD = 7.2$ ).

### Computer/Internet Access

Overall, 99.2% of respondents indicated they had access to a computer (99.0% on-campus; 100.0% off-campus). Those who indicated they had access to a computer 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.

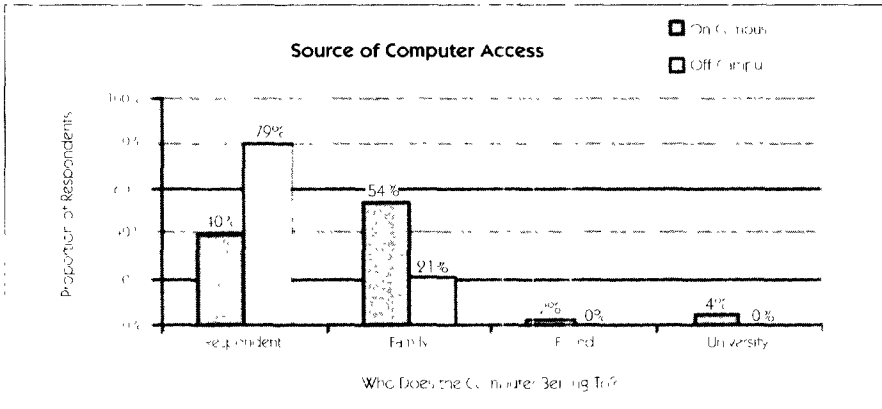


Figure 1. Source of student computer access for on- and off-campus students.

Overall, 90.2% of respondents indicated they had access to the Internet/Web (89.2% on-campus; 95.0% off-campus). Of those that indicated they had access to the Internet, they were further asked to indicate the source of their access. Figure 2 shows the indicated source of student Internet access for on- and off-campus students.

### Computer Usage

Table 1 gives the percentage of respondents who indicated they used a computer regularly, used e-mail regularly, and used the Internet/Web regularly. For

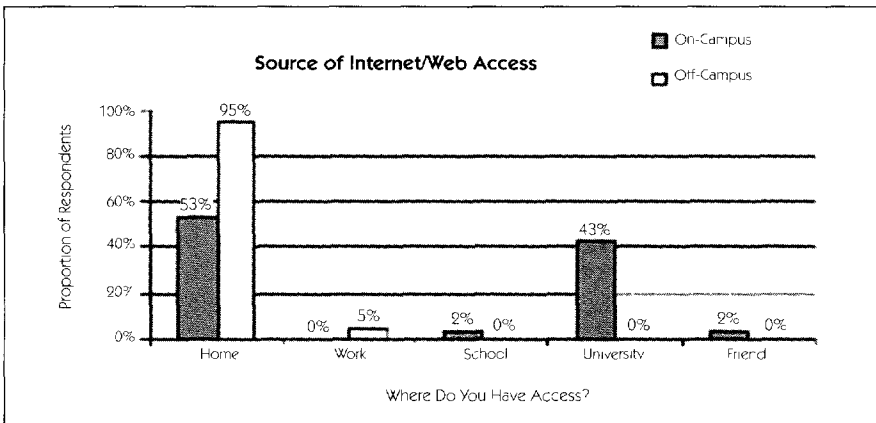


Figure 2. Source of student Internet access for on- and off-campus students.

Table 1. Reported Computer Usage for On- and Off-Campus Students at Start of Semester

	Overall	On-Campus	Off-Campus
Use a computer regularly	77.0%	74.3%	90.0%
Mean reported usage	9.1 hours/week	7.0 hours/week	19.8 hours/week
SD	9.5	5.7	15.8
Use e-mail regularly	38.8%	33.3%	68.4%
Use Internet/Web regularly	52.1%	45.5%	88.9%

those respondents who indicated they used a computer regularly, Table 1 also gives the mean and standard deviation of the reported average hours per week of computer usage.

### Attitude toward Computers in Education

Respondents were asked to indicate (yes or no) which of a series of tasks they felt computers were useful for, and whether they actually used computers for these tasks. Table 2 shows the indicated responses as a percentage of total respondents for both on- and off-campus students. For on-campus students, *other* identified uses and useful applications of computers include personal hobbies, communication, and work. For off-campus students, *other* identified uses and useful applications include work, information, and communication.

Respondents were asked to indicate (yes or no) their agreement with a series of statements relating to the application of computers to teaching and learning. Table 3 shows the indicated responses as a percentage of total respondents for both on- and off-campus students.

## RESULTS—END OF SEMESTER

### Response Rate

From the total end-of-semester unit enrollment of 132, 81 questionnaires were returned, an overall response rate of 61.4%. The on-campus return rate

**Table 2. Identified Uses and Useful Applications of Computers**

	Computers are useful for . . .		I use computers for...	
	On-Campus	Off-Campus	On-Campus	Off-Campus
Games	67.6%	55.0%	65.7%	20.0%
Internet	91.2%	95.0%	79.4%	90.0%
Learning	62.7%	80.0%	44.1%	75.0%
Assignments	98.0%	95.0%	99.0%	95.0%
Other	10.8%	40.0%	11.8%	40.0%

**Table 3. Agreement with Statements Relating to Computers in Teaching and Learning**

For teaching and learning at university...	On-Campus	Off-Campus
Learning from computers could never replace classes/lectures	51.0%	35.0%
Computers could never assist my learning	3.9%	0.0%
Computers could assist my learning	79.4%	90.0%
Learning from computers would be better than classes/lectures	5.9%	20.0%

was 64.0% (64 returns out of 100); the off-campus response rate was 53.1% (17 returns out of 32).

### Demographic Information

Because of the change in student enrollments over the semester, respondent demographic information was collected to ensure comparability between survey groups. The overall end-of-semester respondent gender proportions were 90.1% male and 9.9% female. The overall end-of-semester mean respondent age was 22.1 years. The overall end-of-semester respondent study mode proportions were 79.0% on-campus and 21.0% off-campus.

### Computer Usage

Table 4 gives the mean and standard deviation of the reported average hours per week computer usage at the end of semester for both on- and off-campus students.

### Conferencing System Usage

Table 5 gives the mean and standard deviation of the reported number of times respondents accessed the FirstClass (1999) conferencing system over the semester. Table 5 also shows the reported principal method of accessing the conferencing system, either by means of a Web browser or using the FirstClass client program.

Respondents were asked to indicate their agreement (by selecting one of five points on a Likert style grading scale) with a series of statements relating to



**Table 4. Reported Computer Usage for On- and Off-Campus Students at End of Semester**

	Overall	On-Campus	Off-Campus
Mean reported usage	12.0 hours/week	9.8 hours/week	20.4 hours/week
<i>SD</i>	10.8	6.6	17.6

**Table 5. Reported Conferencing Usage for On- and Off-Campus Students**

	Overall	On-Campus	Off-Campus
Mean times accessed conference	14.0 times	11.2 times	24.8 times
<i>SD</i>	9.4	5.7	12.5
Main access through Web browser	45.7%	35.9%	82.4%
Main access through FirstClass (1999) client	45.7%	54.7%	11.8%
Used both Web and FirstClass client	8.6%	9.4%	5.9%

their use of the FirstClass (1999) conferencing system. Figure 3 shows the mean and standard deviation of the indicated responses from both on- and off-campus students, based on a grading scale of 1 = *strongly disagree*, 2 = *partially disagree*, 3 = *unsure*, 4 = *partially agree*, and 5 = *strongly agree*. Table 6 shows the numerical data on which Figure 3 is based, along with an indication of the statistical significance of the difference between on- and off-campus student responses.

Overall, 34.6% of respondents indicated they had used the conferencing system to communicate with other students (29.7% on-campus; 52.9% off-campus). In addition to the compulsory usage of the conference required to access and respond to weekly questions, there was also a separate, nonformal conference area provided for informal and social communication between all conference members. Student usage of the informal conference area over the 13-week semester is given in Figure 4. A detailed discussion of the observed usage pattern and other results is included in the Discussion section.

### Attitude toward Computers in Education

As at the commencement of the semester and following the use of the computer-conferencing system during the semester, respondents were asked to indicate (yes or no) their agreement with a series of statements relating to the application of computers to teaching and learning. Table 7 shows the indicated responses as a percentage of total respondents for both on- and off-campus students.

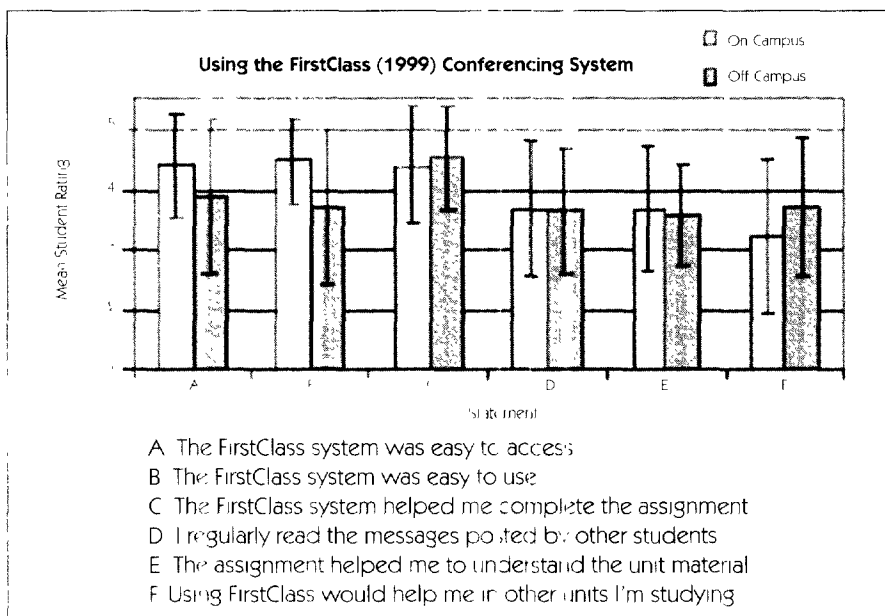
## DISCUSSION

### Response Rate

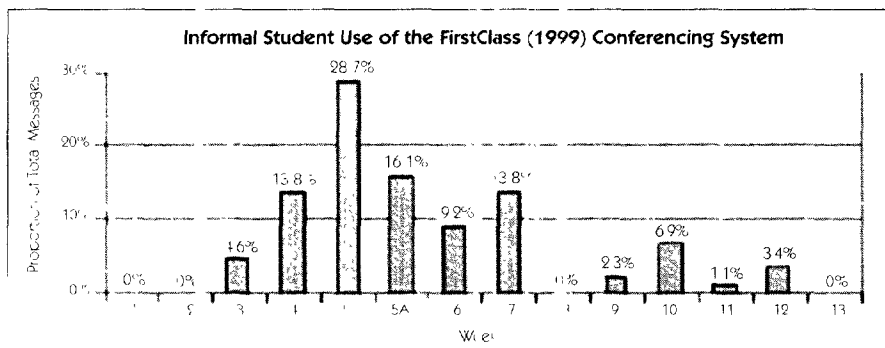
Because of enrollment variations in the first semester of university studies, the number of students enrolled in SEB121 can decrease 15% to 25% over the course of the semester. This, and the fact that students are requested to participate in many surveys at the end of every semester, lead to a decrease in both the number and proportion of voluntary returns for the end-of-semester questionnaire.

**Table 6. Numerical Data on Which Figure 3 Is Based, Including an Indication of Significance**

Statement	On-Campus		Off-Campus		Significance
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
A	4.38	0.84	3.88	1.28	$t(19) = 1.5, p < 0.155$
B	4.47	0.71	3.71	1.27	$t(18) = 2.3, p < 0.034$
C	4.38	0.96	4.53	0.85	$t(27) = -0.6, p > 0.5$
D	3.67	1.12	3.65	1.03	$t(26) = 0.1, p > 0.9$
E	3.66	1.03	3.59	0.84	$t(29) = 0.3, p > 0.7$
F	3.22	1.26	3.71	1.13	$t(27) = -1.5, p < 0.143$



**Figure 3. Student perceptions relating to use of the FirstClass conferencing system.**



**Figure 4. Informal student usage of the FirstClass computer conferencing system.**

**Table 7. Agreement with Statements Relating to Computers in Teaching and Learning**

For teaching and learning at university...	On-Campus	Off-Campus
Learning from computers could never replace classes/lectures	54.7%	41.2%
Computers could never assist my learning	1.6%	0.0%
Computers could assist my learning	92.2%	76.5%
Learning from computers would be better than classes/lectures	1.6%	11.8%

### Demographic Information

The overall commencing female response rate of 13.1% compares closely with the reported commencing female participation rate in Australian engineering undergraduate studies of approximately 14.4% (Department of Education Training and Youth Affairs, 1999). The small absolute number of female respondents suggests caution in making inferences about respondent characteristics based on gender.

The overall commencing age of respondents yielded significantly different distributions between on-campus students ( $M = 18.5$  years,  $SD = 2.1$ ) and off-campus students ( $M = 34.4$  years,  $SD = 7.2$ ),  $t(19) = -9.73$ ,  $p < 1 \times 10^{-8}$ . 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, have full-time employment, 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.

The overall end-of-semester gender proportions were not significantly different to the commencing respondent group,  $t(30) = -0.72$ ,  $p > 0.47$ . The overall end-of-semester mean respondent age was not significantly different to the mean commencing respondent age,  $t(161) = -0.90$ ,  $p > 0.37$ . The overall end-of-semester respondent study mode proportions were not significantly different from the commencing respondent group,  $t(52) = 0.82$ ,  $p > 0.41$ . These results suggest that valid comparisons between the commencing and end-of-semester survey results can be made.

### Computer/Internet Access

For those respondents indicating they had access to a computer, Figure 1 (p. 285) 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 (79%), with a small proportion indicating their family as their source of access. By comparison, 60% of on-campus students list their family, friends, or university as the source of their computer access. The distributions of source of computer access are significantly different between on- and off-campus students,  $\chi^2(3) = 9.94, p < 0.02$ .

Although 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 because of concerns that off-campus students may not necessarily have access to 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.

For those respondents indicating they had access to the Web, Figure 2 (p. 286) shows the differences in the source of that access between on- and off-campus students. Off-campus students are largely self-sufficient, whereas nearly half of on-campus students are reliant on others (principally the university) for their access to the Internet/Web. The distributions of source of Web access are significantly different between on- and off-campus students,  $\chi^2(4) = 18.39, p < 0.0011$ .

It is interesting to note that approximately 10% of on-campus students believe they do not have access to the Internet/Web, when, in fact, all students, both on- and off-campus are provided a computer account through Deakin University that permits access to the Internet, and all on-campus students have access to a large number of both PC and Mac workstations in on-campus computer laboratories. 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. An induction program in computing for on-campus students could be beneficial.

### Computer Usage

The commencing indicated average hours per week of computer usage varied widely (0.5–50 hours per week), with significantly different distributions between on-campus students ( $M = 7.0$  hours per week,  $SD = 5.7$ ) and off-campus students ( $M = 19.8$  hours-per-week,  $SD = 15.8$ ),  $t(18) = -3.41, p < 0.004$ . As at the start of the semester, there were significantly different end-of-semester distributions of reported average hours per week of computer usage between on-campus students ( $M = 9.8$  hours per week,  $SD = 6.6$ ) and off-campus students ( $M = 20.4$  hours per week,  $SD = 17.6$ ),  $t(17) = -2.36, p < 0.031$ . Additionally, there was a significantly higher reported usage at the end of semester compared to the start of semester for on-campus students,  $t(120) = -2.77, p < 0.0065$ , but no significant change in reported off-campus computer usage,  $t(12) = -0.046, p > 0.96$ .

At the commencement of the semester, computer usage by off-campus students was, on average, nearly three times greater than on-campus students. In

one of my previous investigations, an apparent link was found between off-campus students (who are predominantly mature aged) and occupational computer usage (Palmer, 2000), leading to much higher rates of computer usage than their on-campus counterparts. It can be seen that on-campus students have increased their computer usage, on average, by 40% over the duration of the first semester of their studies. This is likely to be because of multiple factors, including (1) greater access to computers in on-campus university computing laboratories, (2) general requirements to use computers in their engineering studies, and (3) the particular requirement in SEB121 to regularly access and contribute to the computer conference.

Even though 99.0% of on-campus students reported having access to a computer, only 74.3% designated themselves as regular computer users; for on-campus students, access to computers does not automatically translate to regular usage. All off-campus students reported having access to a computer, and 90.0% designated themselves as regular computer users. The rate of indicated regular computer usage was moderately different between on- and off-campus students,  $t(36) = -1.94$ ,  $p < 0.06$ .

In both cases, the proportion of off-campus students indicating themselves to be regular users of e-mail and of the Internet/Web was approximately twice that for on-campus students. The regular use of e-mail was significantly different between the two student groups,  $t(25) = -3.01$ ,  $p < 0.006$ . The much higher usage rate for off-campus students may be because of 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. Overall, slightly more than half of the respondents indicated they were regular users of the Internet/Web. As for e-mail usage, there was a significant difference between the reported regular usage of the Internet/Web between on- and off-campus students,  $t(34) = -4.86$ ,  $p < 0.00003$ .

The differing indicated sources of Internet/Web access may explain the differing usage patterns. Ninety-five percent of off-campus students had Internet access at home, making it potentially easier for them to access e-mail and the Web at a time of their choosing, even though access from home would normally involve a cost to the student in access charges from a commercial Internet service provider (ISP). Conversely, only slightly more than half of on-campus students reported Internet access at home, with nearly half reporting that their place of access was the university. Although 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 for on-campus students may account for their lower reported rate of regular use of the Internet/Web.

Both on- and off-campus students reported a high proportion of access to the Web (90.2% overall), so it is not a lack of access that made on-campus students relatively low users of the Web. For this overall 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. Although

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 "online," 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 does not automatically grant access to the information superhighway. 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).

### **Conferencing System Usage**

The reported number of times students accessed the FirstClass (1999) conference had a wide range (3–60 times), with a significantly different distribution between on- and off-campus students,  $t(17) = -4.23, p < 0.0006$ . On average, off-campus students accessed the conferencing system more than twice as many times as on-campus students did. Responding only once per week for the seven compulsory weekly questions meant a student could fully complete the conference-based assignment tasks with a minimum of seven accesses. In practice, the weekly conference areas were left open for contributions beyond that nominal week of the semester, meaning tardy students could access the system infrequently and make several weeks' worth of contributions at once.

Overall, equal numbers of students reported using the Web interface and the FirstClass (1999) client program as their main method of accessing the conference, with less than 10% of students indicating they regularly used both methods of access. The main method of access was significantly different between on- and off-campus students; more than 80% of off-campus students identified the Web as their main mode of access, and more than 50% of on-campus students identified the FirstClass client program as their main mode of access. Off-campus students were encouraged to use the Web interface to FirstClass, as all required conference functions were available by using a Web browser; most off-campus students already had a Web browser installed on their computer, avoiding the need to distribute, install, configure, and become familiar with a new software package. On-campus students were encouraged to use the FirstClass client program available to them in the university computer laboratories; even though tutorial sessions were provided on the use of the client program, a surprising proportion of on-campus students (35.9%) identified the Web as their main mode of access to the conference. This may reflect a section of on-campus students accessing the conference system from home using a Web browser.

Table 6 (p. 289) and Figure 3 (p. 289) summarize student perceptions of the FirstClass (1999) conferencing system. Overall, there was moderate agreement (partially agree or greater) that the FirstClass system (1) was easy to access, (2) was easy to use, and (3) helped students complete the conferencing assignment. Overall, there was less strong agreement (between unsure and partially agree) that (1) students regularly read messages posted by other students, (2) the assignment helped students understand the unit material, and (3) FirstClass conferencing would help with other units studied by the students.

Some moderate statistical differences (Table 6) were observed between on- and off-campus students; off-campus students were less likely to agree the system was easy to access and easy to use, but were more likely to agree that FirstClass (1999) would help them in other units they were studying. These results probably reflect (1) the general difficulties off-campus students face in establishing dial-up, modem-based network connections (on-campus students have access to networked computing laboratories); (2) that most off-campus students used the Web interface to FirstClass (although it provides most features of the client program, the limitations of the Web interface make some functions more cumbersome to use); and (3) that most off-campus students perceive a benefit in any avenue that increases their opportunity to interact with academic staff and other students to create a sense of community and shared experience in their learning.

Although both student groups were equivocal in their support of the statement "I regularly read the messages posted by other students," off-campus students (more than half) were more likely than on-campus students (less than 30%) to report using the conferencing system to communicate with other students,  $t(23) = 1.74, p < 0.1$ . This suggests that many off-campus students found the conference to be a useful medium for communication with their student peers.

Figure 4 (p. 289) shows the proportion of total messages from the informal conference area that were contributed during each week of the academic semester over which the conferencing trial was run. The following points should be noted: (1) on-campus students were not formally introduced to the operation of the FirstClass (1999) conferencing system until week five of the semester; (2) this chart is exclusive of the message volumes generated by the compulsory, assessed conferencing contributions; (3) Week 5A represents an intrasemester lecture break that is not counted in the nominal 13-week academic semester; and (4) other assessable assignment tasks were due for submission in Week 8 and Weeks 12/13.

Use of the conference space before Week 5A/6 is almost exclusively by off-campus students. Following early problems in sending instructions on the use of the conference to off-campus students, informal contributions built steadily from Week 3 as students got themselves online. Informal contributions declined during the intra-semester break and then varied over the remainder of the semester. During Week 8, where an assessment task was due for the unit SEB121, informal contributions dropped to zero. Another major assessment task was due in Weeks 12/13, perhaps being the cause of low informal contributions in Week

12. Week 13 is traditionally the revision/exam preparation week for the semester, with exams following shortly after. No informal contributions were recorded in Week 13, nor any time after Week 13. Noncompulsory, informal conference contributions exhibited early interest and enthusiasm among off-campus students but appear to be highly dependent on external factors that affect the student's capacity to devote time to extracurricular activities.

### Attitude toward Computers in Education

There were no significant differences between the tasks identified by on- and off-campus students that computers are useful for, except off-campus students were moderately more likely (80.0%) than on-campus students (62.7%) to indicate that computers were useful for learning,  $t(30) = -1.7, p < 0.1$ . However, when it came to the reported tasks students *actually* used computers for, there were some significant differences. On-campus students were more than three times more likely (65.7%) to report using computers for playing games,  $t(30) = -4.52, p < 0.00001$ , and off-campus students were significantly more likely to report using computers for learning (75.0%) than on-campus students (44.1%),  $t(29) = -2.84, p < 0.009$ . Off-campus students were slightly more likely to report using computers to access the Internet, and high proportions of both on- and off-campus students (95%–99%) reported using computers to complete study assignments. On-campus students in this unit are principally adolescents, and the high usage of computer games by adolescents is noted in the literature (Griffiths & Hunt, 1998). Off-campus mature-age students seem to have already had experience in using computers for education/learning, though the source of this is unknown. Both groups of students are familiar with the concept of using the computer in completing assignments. In a prior survey of students taking this class, the most commonly reported computer application amongst both student groups was a word processor (Palmer, 2000), suggesting that one of the principal uses of computers for students was as an “electronic typewriter” for the preparation of written work.

At the start of the semester, no significant difference was found between on- and off-campus student agreement with statements in Table 3 (p. 287) relating to computers in teaching and learning; however, off-campus students were moderately less likely to agree that “computers could never assist their learning,”  $t(101) = -2.04, p = 0.044$ , though the level of agreement was low for both student groups; that is, most students felt computers could assist their learning, and off-campus student were more likely to hold this opinion. At the end of the semester, no significant difference was found between on- and off-campus student agreement with statements in Table 7 (p. 290) relating to computers in teaching and learning.

Examining the summary results presented in Tables 3 and Table 7 appears to show some evidence for changes in attitude to computers in teaching and learning over the semester, but statistical analysis of the source data reveals that the changes are limited. The increase in agreement with the statement “computers could assist my learning” by on-campus students from 79.4% to 92.2% is moderately significant,  $t(163) = -2.45, p < 0.016$ , indicating that experience in us-



ing computers in their learning has improved the attitude of on-campus students. Although the following findings were not statistically significant, they are worth noting as patterns. A similar-sized fall in agreement with this statement by off-campus students, from 90.0% to 76.5% is less significant,  $t(28) = 1.10$ ,  $p > 0.28$ , because of the smaller number of off-campus students. The decrease in agreement with the statement "learning from computers would be better than classes/lectures" by on-campus students from 5.9% to 1.6% is moderately significant,  $t(159) = -1.54$ ,  $p < 0.125$ , indicating that the dual experience of the reality of university studies and of actually using computers in learning has reduced the small number of on-campus students who believed learning from computers would be the best mode of education. A similar fall in agreement with this statement by off-campus students, from 20.0% to 11.8% is less significant,  $t(34) = -0.69$ ,  $p > 0.49$ , because of the smaller number of off-campus students. Taken collectively, these results suggest that a semester of experience in using a computer-conferencing system as an assessable component of studies has increased an initial moderate level of support for computers in teaching and learning held by on-campus students and tempered an initial high level of support for computers in teaching and learning held by off-campus students.

## CONCLUSIONS

Hypothesis 1, that significant variations in computer usage would be correlated to student study mode, was confirmed. The following significant differences between on- and off-campus students were noted: (1) the source of computer access, (2) the source of Internet/Web access, (3) the indicated average hours per week computer usage, (4) the regular use of e-mail, (5) the regular use of the Internet/Web, (6) the number of times the computer conference system was accessed, (7) the reported use of computers for playing games, and (8) the reported use of computers for teaching/learning.

The following moderate differences between on- and off-campus students were noted: (1) the regular use of computers, (2) agreement that the computer-conferencing system was easy to access, (3) agreement that the computer-conferencing system was easy to use, (4) agreement that the computer-conferencing system would help them in other units, (5) the reported use of the conferencing system to communicate with other students, (6) agreement that computers were useful for teaching and learning, and (7) agreement that computers could never assist teaching and learning.

Hypothesis 2, that student attitudes to computers and learning would change following participation in a computer-conferencing exercise, was only partially confirmed. At the end of the semester, on-campus students were significantly more likely to agree computers could assist their learning, and off-campus students were moderately less likely to agree learning from computers would be better than classes/lectures. This suggests that before using a computer-conferencing system in their university studies, on-campus students may have been unduly pessimistic and off-campus students may have been overly optimistic about the value of computers in teaching and learning. ■

## Contributors

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