

Increases in Knowledge and Use of Information Technology by Entering Medical Students at McMaster University in Successive Annual Surveys

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ABSTRACT

Objective: To determine self-reported microcomputer and information technology competency, access, and usage by entering medical students and their perceptions of the need for training in additional applications.

Design: Cross-sectional surveys of successive classes.

Setting: McMaster University Faculty of Health Sciences Medical Undergraduate Program, which has a 33-month, problem-based, self-directed learning curriculum and a high applicant-to-student ratio.

Participants: Medical school classes entering in 1987, 1988, and 1989. Response rates were 80%, 90%, and 86% respectively.

Measures: A self-report questionnaire was sent to each student, with up to two follow-up letters to prompt a response.

Results: There was a progressive rise in reported information technology access and use for the three years. For the classes starting in 1987, '88, and '89 respectively, computer access was 29%, 49%, and 49% ($P < 0.002$ for linear trend), and, among those with computer access, modem access was 17%, 29% and 50% ($P = 0.012$). Self-service MEDLINE use on CD-ROM at the Health Sciences Library was 65%, 75%, and 89% respectively ($P < 0.001$) for all respondents within the first few months of starting medical school. Over 50% of each class stated they would take courses, if available, on clinical applications software, office management, online searching, filing, and CD-ROM searching.

Conclusions: Half of the most recent entering students already had access to a personal computer and most wished to learn computer applications that would assist them with patient management, and with information access and organization. Medical schools need to address which applications they will teach or make available and how to bring all students to acceptable competency in their use.

INTRODUCTION

A report of the American Association of Medical Colleges, published in 1984 [1], states: "In less than a decade, the majority of the entering class will have had some computer experience. We must begin now to identify the information processing skills they will need as physicians, develop the resources that will be required to teach these skills, and plan ways of incorporating them throughout the curriculum." Efficient planning for programs and opportunities to help students acquire the necessary skills depends upon accurate information about their level of computer skills on entry and their perceptions of their needs for specific computer applications, now and in the future. To aid our own planning, we designed and distributed a survey on computer access and needs to medical students entering in three successive years, 1987, 1988, and 1989.

METHODS

The survey questionnaire was based on one sent to all faculty members in the Faculty of Health Sciences in February 1986 [2] and again in March 1989 [3]. The class entering in September 1987 was surveyed in May 1988, and the classes starting in September 1988 and 1989 were surveyed in late October 1988 and 1989 respectively. The eight page questionnaire was divided into two parts. The first part focused on ownership and access to personal microcomputers, and, for those with access, computer applications they used. The second part, to be filled out by all respondents, focused on familiarity with microcomputers and general concerns. Up to two follow-up letters were used as reminders.

RESULTS

The response rates for the classes starting in 1987, '88, '89, respectively, were 80% (80 out of 100), 90% (90 out of 101), and 86% (89 out of 104). The median age at entry was 25 years for all three classes and the percentage of females was 69%, 58% and 66% for the three years.

Twenty-nine percent of the class entering in 1987 indicated that they owned or had access to a microcomputer, compared with 49% of the classes of 1988 and 1989 ($X^2[2 \text{ df}] 9.4, P = 0.009$; $X^2[1 \text{ df}]$ for linear trend $9.28, P = 0.002$) (Table 1). Of those with computer access, 4 (17%) of the class entering in 1987 indicated having a modem, compared with 12 (29%) and 22 (50%) for 1988 and 1989, respectively ($X^2[2 \text{ df}] 8.7, P = 0.012$).

Table 1: Number (%) Reporting Computer Ownership or Access for the Classes Entering in 1987, 1988 and 1989, and Expectations for Computer Ownership.

class starting	own or have access to a computer	plan to buy computer (yes or probably)
1987	23 (29)	17 (21)
1988	44 (49)	32 (36)
1989	44 (49)	34 (38)
P-level	0.009	0.042

Table 2 presents the responses about computer uses for students with computer access who made use of their computers. Word processing was the commonest application, with over 90% use for each of the classes. Online database searching was reported by an increasing number and proportion of computer users, rising from 9% of the 23 computer users in the 1987 class, to 52% of the 44 computer users in the 1989 class. There was less use of spreadsheets, database/filing programs, statistical calculations for research, e-mail or self-assessment applications, and no statistically significant trends were found across the three years.

All students were asked about previous formal instruction in computing. About a quarter indicated taking courses in high school, and about a third in university, with no trend across the years.

Table 2. Percent Using Specific Computer Applications among Students with Access to Personal Microcomputers

application	class entering			p-level
	1987 (n=23)	1988 (n=44)	1989 (n=44)	
word processing	91	91	93	ns
online searching	9	27	52	.004
database/filing	35	23	34	ns
spreadsheets	17	30	34	ns
statistics	52	30	32	ns
e-mail	4	16	21	ns
self-assessment	9	0	2	ns

A high proportion of students indicated an interest in taking courses in medical school in various applications as noted in Table 3. More than half the respondents indicated interest in each of the following: a general orientation to personal computer uses in the health sciences; clinical applications; personal online searching of the medical literature; CD-ROM searching of MEDLINE in the library; literature/reprint filing; data management; and office management. While there were significant differences among the classes for some of these, there was no significant trend over the years.

Table 3. Percent of All Students Interested in Taking Specific Computer Courses

course	class entering			p-level
	1987 %	1988 %	1989 %	
orientation	68	81	75	ns
clinical applications	94	94	90	ns
online searching	68	87	81	ns*
CD-ROM searching	54	69	52	ns
filing	67	84	70	ns*
e-mail	51	49	63	ns
office management	71	84	76	ns
word processing	45	46	40	ns
data management	40	73	49	ns*

* χ^2 significant for differences between groups, but not for linear trend

Students were also asked what computer applications they had already begun to use in the Health Sciences Library. Noting that the class entering in 1987 was surveyed about nine months after entry while the two later classes were surveyed about two months after entry, some interesting trends are apparent. First, despite the much shorter exposure time, significantly more students in the classes entering in 1988 and 1989 indicated online and CD-ROM use of MEDLINE. This was not due to any formal changes in the curriculum. The higher reported use of educational software in the library by students in the class entering in 1987 is presumably due to the longer period of exposure at the time of the survey.

Table 4. Percent of Students Using Computer Applications in the Health Sciences Library

<u>application</u>	<u>class entering</u>			p-level
	1987 %	1988 %	1989 %	
CDROM MEDLINE	65	75	89	.001
computer-aided instruction	78	17	17	.001
online searching	10	20	25	.01

Students were asked whether five specific computer applications should be available in the school and whether they thought the applications should be provided free of charge (Table 5). Demand was uniformly high for all applications in all three classes. Most thought database searching, educational software, and self-assessment software should be provided free, while a slim majority thought that students should be charged a fee for access to database management and word processing programs.

Table 5. Percent of Students Indicating Computer Applications that Should be Supplied by the Medical School (% Indicating Should be Supplied Free)

<u>application</u>	<u>class entering</u>		
	1987 %	1988 %	1989 %
database searching	90(83)	89(77)	96(88)
educational software	91(86)	89(86)	92(87)
self-assessment software	98(95)	88(84)	94(89)
database management	85(39)	84(41)	89(43)
word processing	85(48)	90(50)	91(56)

Finally, students were asked if all students should have their own computer. The affirmative responses for the three classes were 37%, 40%, and 40%, respectively (n.s.).

DISCUSSION

Our surveys were intended to provide information for planning. Because the learning approach is self-directed, one objective of planning is to react to, or keep pace with, changes in student resource utilization, and the surveys have provided quantitative data concerning utilization. They show increasing access to computers and avidity for a number of applications of relevance to medical education and practice. Almost all students had word-processing experience on entry to medical school and increasing numbers had had experience with online database searching. Interest was high for learning new uses, particularly clinical applications, database

searching, filing and office management. Interest was turned into action early on in the program, with increasing numbers of students using the library's self-service CD-ROM MEDLINE and online searching facilities during the first few weeks of school. This has led to the provision of increasing numbers of CD-ROM stations and CD-ROM titles in the library. While do-it-yourself CD-ROM is provided free of user charge, students must pay the online charges for direct use of MEDLINE searches through the Elhill system in Bethesda. Although students felt that the school should provide access to many applications, most felt that students should be expected to pay for database management and word processing.

The increases we observed in information technology access and use in students were paralleled by similar increases among faculty members [3], with 71% of faculty in 1986 reporting computer access, and 87% in 1989. Over half of the faculty respondents indicated that the following services should be provided free to students: online searching of databases, educational software, and self-assessment software.

Students attending medical school at McMaster University differ from those attending other Canadian medical schools in a number of ways. They are older on average, a higher percentage are women, and fewer have standard, biologically oriented, pre-medical training. The curriculum at McMaster is problem-based, student-centred, and self-directed, and students are expected to track down the answers to questions that come up in the process of discussing the biomedical problems they are presented with from the first day of school. This type of program places a premium on information acquisition skills and, consequently, on the information services provided by the institution. Although the students were polled early after starting their first year of school, they are well aware of the school's curriculum when applying and are likely self-selected for this approach to learning. Thus, the findings reported here may not be generalizable to schools with traditional curricula.

The increasing interest of students in information technology and applications is not due to the introduction of new courses at the school because there are no formal courses. It may be that the increasing interest is due to the students' own familiarity with computers, to increasing enthusiasm of the faculty [3], to the provision of more information resources by the Faculty, to increasing sophistication of software of value for medical learning in general or for management of medical disorders, or, most likely, all of these.

The 1984 prediction of the American Association of Medical Colleges [1] that, within a decade, the majority of the entering class will have had some

computer experience, appears to have come true, perhaps a bit ahead of schedule among our students. The challenge now is to keep pace with both students' information needs and the development of better information resources. In a problem-based curriculum, this may be best accomplished by providing access to information services - CD-ROM and online databases, educational software, and so on - rather than providing formal instruction in computer skills. Thus, because of demand, the library has increased its CD-ROM titles from one to seven in a matter of a few years, with multiple subscriptions for the most popular titles, and provides an increasing range of hardware and software. The library and the medical school have offered an increasing number and selection of short courses on computer skills and applications, according to demand, as well.

Computer resources and courses might be used quite differently in teaching environments that do not require students to find answers to problems as the main mode of education.

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