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# **A study of library use in problem-based and traditional medical curricula\***

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A key question for librarians and medical educators who are planning for curriculum change is whether students and faculty in problem-based learning (PBL) programs use the library and its resources differently than do participants in traditional programs. During 1991, this research question was explored at three medical schools in the province of Ontario, Canada. At the time of the study, McMaster University medical school was totally problem-based, the University of Western Ontario had one PBL day each week for first-year medical students, and the University of Toronto, although planning for medical curriculum change, had not yet initiated PBL. Data collected in the study suggest that more medical students in the problem-based curriculum than in the more traditional programs use the library and that, when the PBL students use the library, they do so more frequently, for longer periods of time, and as a source of a greater proportion of their study materials. PBL students also use the library more than their counterparts as a place to study and meet other students. Students in the problem-based curriculum use the following resources more extensively: end-user MEDLINE searching, library journals, reserve or short-term loan materials, photocopy services, and audiovisual materials. PBL students also report purchasing more textbooks. In contrast to the differences found among medical students, however, patterns of library and resource use by medical faculty at the three schools were quite similar.

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In response to current trends in medical education, a growing number of medical schools are implementing problem-based learning (PBL). PBL is generally described as student-centered learning in which students generate study issues with faculty guidance. Students are encouraged to pursue their own learning using a variety of resources, ranging from the medical literature and laboratory work to clinical observation and consultation with experts. PBL has been described extensively in the medical education literature by such authors as Barrows and Tamblyn [1] and Kaufman [2].

A key question for librarians and medical educators, as well as for educators from other health professions who are considering or implementing curriculum change, is whether students and faculty in PBL programs use the library and its information resources differently than do participants in traditional programs. If so, these differences should be taken into account in library planning. Research on this topic also may be of interest to academic health sciences librarians who have been invited by Dr. Donald G. Kassebaum, cochair of the Liaison Committee for Medical Education (LCME), to engage in regular correspondence with LCME regarding issues such as the adequacy of financial support for libraries in view of changing educational emphases [3].

Earlier studies at single institutions such as McMaster University [4], Rush University [5], Bowman Gray University [6], and the University of New Mexico [7] suggest that resource use is one of the major differences between students in problem-based and traditional curricula. Rankin's study of second-year medical students at four institutions also found greater library use by PBL students than by those in traditional programs [8]. No studies were found that specifically examined library use by medical faculty in PBL settings.

An opportunity arose in 1991 to gather comparative library use data from both medical students and faculty in Ontario, Canada, where several medical schools were at different stages of PBL adoption. The McMaster University medical program has been oriented toward PBL since it was founded in 1965. At the time of the study, the University of Western Ontario medical school had one day per week of PBL for first-year students, consisting of a two-hour tutorial and then individual study. During 1991, the University of Toronto medical faculty were planning for PBL as part of a curriculum renewal process but had not yet introduced it. A window of time existed in which the results of a comparative study could be useful to all three institutions for planning purposes.

## METHODOLOGY

The following methods were employed to collect data over a two-month period:

- an exit survey, administered to everyone leaving the library during predetermined two-hour time slots over a seven-day period, a total of 14 hours—the two-hour time slots covered day, evening and weekend hours;
- a survey of users who did their own MEDLINE searches in the library;
- a survey on library use habits, distributed to all medical students;
- a survey on library use habits, distributed to all full-time and part-time medical faculty; and
- a comparison of the statistics submitted by the three schools to the Association of Health Sciences Library Directors for 1990–1991, supplemented by more detailed library circulation data for a two-month study period.

At McMaster and the University of Western Ontario, data were collected during the spring term, January to April 1991. Data collection for all instruments except the MEDLINE questionnaire was delayed at the University of Toronto until the fall term, September to December 1991, due to a library workers' strike during the spring term. Fall and spring terms are similarly busy for the libraries and the medical programs, so the data from the two time periods were considered comparable for purposes of the study. As much care as possible was taken to ensure that no extraordinary educational events were ongoing in the medical curricula or the university at the time of the study that would result in atypical library use of some sort, particularly during the period of the exit survey. One factor that could not be avoided was construction in the library at the University of Western Ontario. Although the library was fully operational during this period and circulation was not affected, it is possible that users who were disturbed by the noise may have spent less time in the library. Library users were asked to complete only one exit survey.

The rationale for the multifaceted approach to data collection was that, in the authors' judgment, no single instrument would have provided a definitive answer to the research question. There were differences among the libraries in terms of location, collection, organization, staffing, and facilities that could have acted as confounding variables. Despite these differences and some of the other aforementioned limitations on the data collection, consistent results obtained through a number of different approaches could be expected to bolster the validity of the overall findings. The exit survey was considered the most reliable data collection instrument because of the high response rate and the accuracy of self reports, so the findings of this survey are emphasized in the discussion of the results.

## RESULTS

### Exit survey

During the fourteen-hour exit survey period, 1,132 questionnaires were collected at McMaster Health Sciences Library, 955 at the University of Western Ontario Sciences Library (now renamed the Allyn and Betty Taylor Library), and 1,440 at the University of Toronto Science and Medicine and Sigmund Samuel libraries. (The Sigmund Samuel Library for undergraduates shares an exit with the medical library.) At McMaster, 161 medical students (54% of 297 students enrolled) completed exit surveys during the fourteen-hour period, compared to 36 (9% of 415 students) at Western Ontario, and 46 (5% of 1,002 students) at Toronto. These results indicate that a much higher proportion of medical students in the PBL program use the library than do students in the other programs.

Although it is desirable to organize these data by the students' year of study, the data are somewhat difficult to interpret, because a number of medical students identified themselves as "graduate students" rather than by their year in the medical program. Even with this limitation, a notable three quarters (73%,  $n = 117$ ) of the medical students at McMaster indicated that they were in their first (32%,  $n = 52$ ) or second year (40%,  $n = 65$ ). By contrast, only 25% ( $n = 9$ ) of the exiting students at Western Ontario and 35% ( $n = 16$ ) at Toronto identified themselves as in their first or second year. The one day per week of PBL at Western Ontario was offered to first-year students at the time; however, only five of the thirty-six medical students surveyed at Western identified themselves as in their first year. A more detailed study over a longer time period would be required to estimate the impact on the library of the limited PBL program. The McMaster results suggest that heavier use of the library by PBL students may be concentrated in the early years of the program.

Respondents to the exit survey were asked to estimate how long they had been in the library on that particular visit, how many visits they made per month, and the proportion of their study materials that came from the library. Again, the results show that medical students in the PBL program were more intensive library users than were students in more traditional programs. The mean length of library visits at McMaster is 157 minutes (SD 150), compared to 71 minutes (SD 68) at Western Ontario and 103 minutes (SD 104) at Toronto. The mean number of estimated library visits per month during the term is 54 (SD 44) at McMaster, 12 (SD 16) at Western Ontario, and 16 (SD 19) at Toronto. McMaster medical students estimate that 66% (SD 25) of all their study materials come from the library, compared to 42% (SD 35) at Western Ontario and 44% (SD 33) at Toronto. As stated earlier,

Western Ontario library was undergoing construction, which may have affected the reported length of visits.

The specific library activities reported by medical students are shown in Table 1. The data indicate that a higher proportion of students at McMaster than at the other schools use reference books such as dictionaries and handbooks, read library journals, read library materials on reserve or short-term loan, photocopy library journals, use audiovisual materials, and use the library as a place to study. McMaster students also use the library as a place to meet other students and to arrange study activities. A relatively small proportion of the McMaster students asked library staff for assistance compared to the other schools; this could be due to the PBL students' frequent library use and their familiarity with the resources and services. Even though a smaller proportion of PBL students ask for staff assistance, the greater number of PBL students using the library still results in greater demands on staff time.

Over 85% of the exit survey respondents at each location were students, about 5% were faculty, and the remaining 10% were staff or "other"; that is, another category not listed on the survey. In comparison to students, faculty members were not frequent users of the library at any of the three schools. One McMaster faculty member stated that faculty actually used the library less when teaching in a PBL environment, because PBL students were more likely to identify useful sources than students in traditional programs.

### MEDLINE use

In the exit survey, MEDLINE searching was reported frequently by medical students at all three libraries (Table 1); however, these results may be skewed by the greater overall library use at McMaster. At the time of the study, McMaster had four CD-ROM workstations, and Western Ontario had three, both using the Compact Cambridge version of MEDLINE. The University of Toronto had mounted CD Plus MEDLINE, which was available on over a dozen terminals in the Science and Medicine Library. Prior to the CD Plus implementation in November 1990, a single user workstation with Compact Cambridge MEDLINE had been available. End-user MEDLINE searching was available free at all of the sites.

Additional data about MEDLINE use was gathered using a separate questionnaire. Copies of the questionnaire were made available throughout the spring 1991 term; users were asked to complete them on a voluntary basis, often with the encouragement of library staff. A total of 599 questionnaires were completed at the three sites: 201 at McMaster, 180 at the University of Western Ontario, and 218 at the Uni-

**Table 1**  
Library activities reported by medical students in exit survey

	McMaster %	Western %	Toronto %
<b>Searched by</b>			
Browsing shelves	36	39	20
Library catalog	25	27	44
Printed indexes and abstracts	14	33	2
MEDLINE, yourself	39	33	35
Reference books (dictionaries, etc.)	28	17	9
<b>Read or borrowed library materials</b>			
Read library journals	58	39	39
Read library books (general collection)	25	25	17
Read reserve materials	39	17	7
Borrowed books (general collection)	21	25	26
Borrowed reserve materials	32	17	0
<b>Used library services</b>			
Photocopied library journals	64	50	41
Photocopied own notes or materials	20	22	15
Asked library staff for assistance	21	28	30
Used AV materials	24	6	7
Used the library as a place to study	39	19	30
Used the library for another purpose	15	3	4
	<b>No.</b>	<b>No.</b>	<b>No.</b>
Medical students who completed the exit survey	161	36	46
Medical students enrolled*	297	415	1,002

\* Differences in library use are particularly evident when the numbers of medical students who completed the exit surveys in the fourteen-hour period are seen as a percentage of medical student enrollment at each site; that is, 54% at McMaster compared to 9% at Western Ontario and 5% at Toronto.

versity of Toronto. The following percentages are based on the number of respondents who answered each particular question.

McMaster users searched more often than did other users. Over half (56%) of the McMaster respondents had searched more than twenty times before, compared to 19% at Western Ontario and 22% at Toronto. McMaster respondents were more likely to have received some type of formal instruction or class in MEDLINE (30%, compared to 16% at Western and 13% at Toronto), but they also were more likely to report "trial and error" as a method of learning to search (78%, compared to 64% at Western and 61% at Toronto). McMaster users also more often reported that friends had helped them learn to search (42%, com-

pared to 25% at Western and 20% at Toronto). Respondents also were asked whether they owned a computer and a modem, and results were similar at the three sites: at McMaster, 59% owned a computer and 22% a modem; at Western Ontario, 49% owned a computer and 18% a modem; and at Toronto, 59% owned a computer and 29% a modem.

Some MEDLINE findings suggest that PBL influences not only library use but also the way in which library learning takes place. PBL students are more likely to take advantage of MEDLINE instruction but also learn from friends and use trial and error as a learning method. The demands that PBL makes on library staff are also of interest. More students at McMaster than at other schools had taken some type of

**Table 2**  
Estimated number of library visits per month reported in medical student and medical faculty surveys (mean)

	McMaster		Western		Toronto	
	Faculty (n = 327)	Students (n = 64)	Faculty (n = 305)	Students (n = 121)	Faculty (n = 420)	Students (n = 101)
Medical School library visits	7.4 (SD 18.1)	39.0 (SD 32.6)	5.6 (SD 12.4)	7.3 (SD 12.0)	4.1 (SD 7.5)	2.8 (SD 4.5)
Other campus library visits	1.2 (SD 3.7)	0.3 (SD 0.8)	1.4 (SD 5.7)	3.3 (SD 5.5)	1.6 (SD 5.0)	2.3 (SD 9.8)
Hospital library visits	3.0 (SD 6.4)	1.1 (SD 2.9)	5.2 (SD 10.4)	2.0 (SD 3.9)	6.5 (SD 12.7)	3.1 (SD 5.5)
Total library visits	11.6	40.4	12.2	12.6	12.2	8.2

**Table 3**  
Selected characteristics of participating libraries and medical schools\*

	McMaster	Western	Toronto
<b>Facilities and services</b>			
Hours open per week	103.5	87.3	90
Study seating capacity	549	671	336
Square feet of space	38,905	40,394	61,850
Professional staff (M.L.S.)	9	5.25	11.8
Public microcomputers or terminals	20	9	17
<b>Collection</b>			
Volumes	129,375	360,019	791,490
Current serial titles	1,823	not reported	3,240
<b>Use and users</b>			
Circulation	55,438	172,319	250,474
Reserve or short-term loan circulation	112,667	7,641	4,323
Gate count	576,278	569,035	not reported
Number of medical students	297	415	1,002
Number of medical faculty (full-time and part-time)	908	1,062	1,260

\* With the exception of the number of medical students and the number of medical faculty, the figures are those submitted for publication in the *Annual Statistics of Medical School Libraries in the U.S. and Canada, 1990-1991*, 19th ed.

formal MEDLINE instruction from library staff, but the exit survey found that a smaller proportion of McMaster students asked library staff for assistance. As mentioned earlier, the actual number of requests for assistance is still higher at McMaster because of the greater number of PBL students who use the library. The results also suggest that additional staff effort must be devoted to PBL students initially but that, in the long run, PBL students may become more self-sufficient than students in traditional programs.

### Student and faculty surveys

In addition to the exit and MEDLINE surveys, questionnaires were distributed to students and faculty to gather more data on library and resource use. The surveys were intended to gather information from both library users, the group represented in the exit survey, and nonusers. Because the rate of library use by faculty members was only 5% in the exit survey, the faculty survey was seen as an important means of gathering additional data about this group. All faculty questionnaires were addressed personally and were sent by campus mail. Student questionnaires were distributed in class or placed in student mailboxes. No follow-up activities for nonrespondents were possible, due to financial constraints.

At McMaster, 22% (n = 64) of students and 36% (n = 327) of faculty members returned their questionnaires; at Western Ontario, 29% (n = 121) of students and 29% (n = 305) of faculty members did so; and at the University of Toronto, 10% (n = 10) of students and 33% of faculty (n = 420) responded. Despite these low response rates, the data tend to confirm the trends observed in the exit and MEDLINE surveys. Table 2

shows that the estimated number of library visits by medical students is much greater at McMaster than at either Western Ontario or Toronto. Although faculty at Western Ontario and Toronto reported using their hospital libraries more frequently, the total estimated number of library visits for medical faculty at the three institutions is very similar. For medical students, a visit was defined as an in-person visit; for faculty, a visit could be a personal visit, a telephone or mail request, or could involve library use by a staff member or student on the faculty member's behalf.

The reported amount of time spent by faculty in teaching activities is also similar at the three schools: 18% at McMaster, 18% at Western Ontario, and 21% at Toronto. This finding is similar to that of Mennin and Martinez-Burrola who state that, contrary to popular assumptions, faculty time devoted to PBL is no greater than that devoted to traditional education [9]. The faculty members at each school reported that their most frequently used information resources for teaching activities are personal files and their own books and journals. These resources are the only ones on a list of fourteen possible resources that were rated at least 4 on a five-point scale, where 1 was "seldom or never used" and 5 was "always used."

### Comparison of libraries

As shown in Table 3, which is based on statistics reported to the Association of Academic Health Sciences Library Directors for 1990-1991 [10], student enrollments and library collections, staffing levels, and facilities differed at the three libraries. The McMaster Health Sciences Library serves health sciences students only as its primary clientele (i.e., there is a

separate Science Library on campus); the University of Western Ontario and University of Toronto libraries serve additional types of science students. Despite its more limited clientele, the McMaster gate count (i.e., the number of persons counted automatically upon exiting the library) is very close to that at Western Ontario. Because Toronto's Science and Medicine Library shares an exit with the undergraduate library, no comparative gate count is available for the purposes of this study.

Differences in the scope of collections and primary user groups likely account for differences in the circulation of general materials, which was higher at Western Ontario and Toronto than at McMaster. At the time, the University of Toronto library was still circulating its journals, which also inflated circulation figures. Particularly notable at McMaster is the large number of items circulated from the reserve or short-term loan collection. These data, as well as results of the exit survey and the medical student survey, support the finding that such materials are used heavily by PBL students. The fact that these materials are on reserve, often as a result of being identified as resources in PBL learning packages or on reading lists, rather than being part of the general library collection, suggests some limits on the extent to which PBL students seek out library resources independently. This finding deserves attention by librarians and medical educators, who are trying to foster lifelong learning skills among PBL students.

The general circulation statistics do not provide data about the borrower's affiliation or academic unit. To further investigate circulation of materials to medical faculty and students, detailed circulation data containing departmental affiliation were gathered for a two-month period during the study. These data support the observed pattern of increased use of library materials, particularly reserve materials, by PBL students. The total number of library items borrowed and renewed during the two-month period by users affiliated with the medical school was approximately five times higher at McMaster than at the other two schools. Much of this additional circulation can be attributed to high circulation of items in the reserve or short-term loan collection. Another indicator of greater resource use by PBL students—this time outside the library—was found in the student survey results. PBL students at McMaster reported purchasing an average of nine ( $n = 58$ ,  $SD 6$ ) textbooks during the current school year, compared to five ( $n = 111$ ,  $SD 4$ ) at Western Ontario and five ( $n = 82$ ,  $SD 2$ ) at Toronto.

## CONCLUSIONS

Data collected using five different measures suggest that a greater proportion of medical students in the

problem-based curriculum than in traditional programs use the library and that, when they use it, they do so more frequently, for longer periods of time, and as a source for a greater proportion of their study materials. PBL students at McMaster report using the following resources more extensively than students at Western Ontario and Toronto: end-user MEDLINE searching, library journals, reserve or short-term loan materials from the library, photocopy services, and audiovisual materials. The PBL students also use the library more than do their counterparts as a place to study and to meet other students. The McMaster students report purchasing more textbooks than do students at the other two schools. On the other hand, patterns of library and resource use by medical faculty at the three schools are quite similar.

While library and resource use may be affected by many factors, such as library location, collection, physical facilities, and number and quality of library staff, it seems unlikely that these factors could be entirely responsible for type and magnitude of differences observed in this study. More likely, the nature of the PBL curriculum itself, with its emphasis on self-directed learning and resource identification and use, has a major impact. The results suggest that librarians and medical educators should consider the increased demands that PBL students are likely to make on both the medical school and hospital libraries, particularly in the first two years of the program. Because the differences in resource use appear to be much greater for PBL students than for PBL faculty, convincing faculty of the increased resource needs, especially in these times of financial constraint, may be more difficult than expected.

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