

Innovative Approaches by École Polytechnique de Montréal Library in Support of Research Activities

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Abstract

Librarians are better able to respond to the needs of their end users while supporting the goals of their institution. This is illustrated through five recent initiatives undertaken by the Library of Ecole Polytechnique in direct support of institutional research activities:

- Master's and Ph. D. students develop information skills through the preparation of a portfolio on their research topic. This assignment forms part of an information literacy laboratory within a research methodology course. The course is mandatory for Ph. D. students and assignment grading is done by librarians;
- Canada Research Chairs benefit from dedicated information services in return for a financial contribution by each Chair to the Library;
- a bibliographic database with citations to the scientific and engineering publications of the institution's faculty and researchers is available via the Internet. A knowledge management tool, the database is also useful for marketing and promoting the institution;
- a three-pronged approach to analyzing user needs allows the Library to identify those journals containing 80% of the articles published or cited by the institution's faculty and researchers;
- a comparative analysis of publication data for fifteen Canadian engineering schools aids the institution in developing its strategic positioning.

Keywords

Academic libraries, Bibliothèque de l'École Polytechnique de Montréal, citation analysis, core journals list, engineering education, faculty publications database, information literacy, innovation, library services.

Introduction

Founded in 1873, École Polytechnique de Montréal has close to 6,000 students. It is distinguished by its strong research activities: 43% of its funding comes from contracts and research grants while a third of its students are enrolled in graduate studies.

The Library reports to the Research and Innovation Directorate. Such a connection necessarily influences the Library's strategic orientation. This article presents five recent Library initiatives aimed at improving support for research. The Library's scope of activities is varied; thus the initiatives touch on researcher training, on value-added services provided to research groups, on the promotion of publications, on the rationalization of the journal collection and on the comparative analysis of scientific literature production.

Information Literacy

Graduate students must be able to find and manage the information needed for their research. In 2001, Polytechnique's Graduate Students Association, its Teaching and Learning Centre, its Graduate Studies Directorate and its Library agreed upon this common goal.

Also in 2001, Polytechnique reviewed its advisory and support policies for graduate students. A survey of the research advisors revealed that 77% of them noted a need for improved research and information management skills. At the time, the Library was offering graduate students three-hour, voluntary workshops on ProCite®. As well, a librarian was invited into three graduate courses per semester to teach students how to use information sources in two-hour sessions.

The challenge was to implement information literacy in such a way as to reach every graduate student. Working with the aforementioned groups, the Library found a "niche" within a Research Methodology course. Mandatory for Ph. D. students, this course was also strongly recommended for Master students writing a research thesis. The answer to the challenge was achieved through the inclusion of laboratory sessions – 12 hours in total – into the course and under the responsibility of the Library.

After a review of graduate information literacy programs such as those at Chalmers University and at Queensland University, an outline was developed. The librarian who taught the workshops and classroom sessions prepared a curriculum, drawing upon both actual experience and the ACRL standards for information literacy for guidance.

The objectives of the lab are to enable students to:

- define their information needs and formulate a search strategy based on a concept plan;
- efficiently and exhaustively search databases relevant to their research topics, exploiting their advanced functions;

- select and evaluate citations extracted from these sources;
- create current awareness profiles to enable continuous updates and to become familiar with technological intelligence techniques and sources;
- manage their own database of citations using the personal bibliographic software ProCite®.

The lab's content is divided into three modules:

- introduction to sources and basic searching (4 hours);
- advanced search techniques and current awareness profiles (4 hours);
- management of citations in a personal database (4 hours).

Each student produces lab reports which are then reviewed by librarians. These reports plus a final, global report are assembled into a "portfolio". The portfolio, incorporating changes and the feedback of the librarians, thus reflects the evolution of the students' knowledge and capabilities. It is graded by the librarians and accounts for 50% of the total course mark.

The portfolio must contain:

- a personal, detailed concept plan;
- basic search strategies;
- advanced (optimized/tailored) search strategies for two databases;
- search results;
- a discussion/justification of the concept plan and of the choice of keywords. The student explains which advanced functions were used and why;
- a current awareness profile and the justification for the choice of intelligence techniques utilized;
- a portion of a database built with ProCite® and a bibliography generated with this application.

Number of students taught is on the rise since the introduction of lab sessions in 2001.

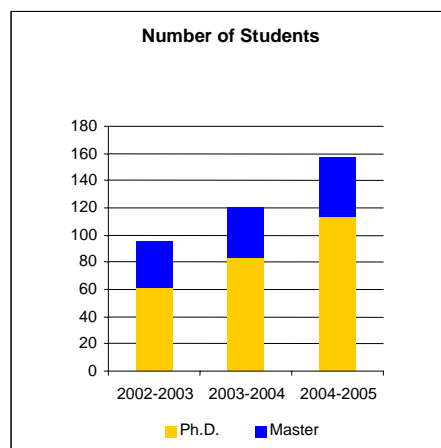


Figure 1

Polytechnique's Teaching and Learning Centre helped to develop and compile a survey assessment tool distributed at the end of each term to all students.

Overall, the satisfaction rating is very high - over 90%. The only negative comments pertain to the workload, since students are required to revise their work in order to submit a final, strong portfolio. This teaching method is very useful for students, due in part to its personalized focus on an individual student's research topic.

The program models the "ideal" behavior of a student who conducts a thorough literature review. Upon completion, students have in hand all of the material required to undertake their research projects. The course's coordinator estimates that, in some cases, the total research project time saved might be as much as four months.

Research Support for Canada Research Chairs

In 2001, ten Canada Research Chairs were awarded to Ecole Polytechnique. The Chairholders agreed to transfer a percentage (2.5%) of their grants to the Library in return for dedicated information services. A Library task force submitted a service proposal, a budget and an implementation plan. Essentially, the proposal was to dedicate a librarian to provide value-added services to the Chairs, including streamlined document delivery services.

This arrangement was accepted by the Chairholders in 2002 and a senior librarian was hired in late 2003. The first annual report was presented to the Chairs in 2004 with priorities established for the second year of operation, including the need for a library assistant. A library assistant was hired this year. In 2005, the revenues from the Chairs amounted to \$72,000.

Following are a few examples of value-added services provided to the Chairs.

The librarian conducts literature searches on advanced technologies, focusing on patent searching and business opportunities, trends and forecasts and keeping in mind the possible commercial spin-offs from the Chairs' research activities.

Role of the Librarian

- Assist and advise the Chairs on information and documentation issues.
- Establish and maintain relations with the Chairs, in order to make known the activities and services of the Library and to better understand their needs.
- Train the Chairs and, in particular, students at the Master's and Ph. D.levels in the use of scientific and technical information.
- Collect available information in support of the activities of the Chairs.
- Select and recommend the acquisition of information resources responding to the needs of the Chairs.
- Keep current with regard to information systems and resources in order to respond to the needs of the Chairs.
- Prepare an annual work plan in conjunction with the Canada Research Chairs and prepare an annual report of activities.

Also, significant work has been done to develop and manage bibliographic databases using the ProCite® and EndNote® applications, with the support of the Chairs' administrative staff. This permits the Chairs to manage their personal collections and their often large – sometimes in excess of 10,000 -number of citations and to produce bibliographies for articles and research grant applications.

Finally, it is important to emphasize that the librarian provides services to the Chairs as well as to the people working with them: administrative staff, research assistants, graduate students and post-doctoral researchers. Based on their job requirements, these people are given individual or group coaching and training in the use of bibliographic software and in literature searching techniques.

Taken together, these and other services contribute to developing a knowledge management culture within Polytechnique. For the Library, this arrangement provides a unique opportunity to work in close association with researchers and to develop new, fruitful areas of specialization. Ultimately, the Library envisions extending these services to all research groups.

Database of Faculty Publications

(<http://www.polymtl.ca/biblio/trouver/repertoire/index.php>)

For many years, École Polytechnique published a document entitled *Publications scientifiques* which contained a list of its professors' and researchers' publications. Due to a lack of resources, this document ceased publication in 1994.

Five years later, given the importance of such a tool for the research community, Polytechnique gave the Library the mandate to resurrect this publication. In Polytechnique's strategic plan, this document was identified as a useful tool for improving the circulation of research results. The *Répertoire des publications scientifiques et techniques* thus reappeared in May 2003.

The *Répertoire* lists journal articles, theses, dissertations, patents, conference papers, books, book chapters, and technical reports produced by Polytechnique's professors and researchers since 1994. Updated yearly, the *Répertoire* is in the form of a searchable database accessible on the Web through a French-language or a user-selectable English-language interface.

The database is prepared as follows:

1. **Importing the bibliographic data**
Bibliographic data are imported from some sixty commercial databases. The data for master's theses and doctoral dissertations are imported from the Library catalogue.
2. **Standardizing and enriching the imported citations**
The standardization of certain bibliographic data such as journal titles is undertaken. Polytechnique's authors and their departmental affiliations are also identified and a link is created to an experts repository.

3. Validating the data

For each professor and researcher, a bibliography of publications is produced. Each person is invited to submit corrections and to advise the Library of any missing publications.

These three steps are accomplished using the ProCite® software. One last step is necessary to make the *Répertoire* accessible via the Web: citations are converted to the MARC21 format to permit integration into the Library catalogue.

The *Répertoire* covers the totality of publications produced since 1994 by Polytechnique's professors and researchers. In total, 9,348 publications are included: journal articles account for 41% of the *Répertoire*, conference papers comprise 34% while dissertations and theses total 19%. Books and book chapters, patents and technical reports account for the remaining 5%. It should be noted that more than 90% of the data concerning journal articles are imported while some 40% of the data about conference papers are provided by their authors.

Répertoire – Advanced search form

Recherche complexe par MOTS CLÉS dans Répertoire des publications scientifiques et techniques de l'École Polytechnique

Chercher dans dans

et dans

Trier selon afficher

Note: Si le résultat de votre recherche contient plus de 200 notices, celles-ci ne seront pas triées.

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Figure 2.

Work on the creation of the *Répertoire* was spread out over two years. The first version covered the years 1994 to 2001 and required the equivalent of one person-year and \$25K (cost for database searches and for data integration into the library catalogue). The yearly update requires 0.25 person-year and costs around \$1K.

The accessibility of the *Répertoire* on the Web ensures a wide circulation of the results of research undertaken by Polytechnique's professors and researchers. For example, in a few clicks, users can retrieve the entire list of journal articles written by a professor.

As well, hyperlinks to the experts repository provide details on that same professor's body of work. With ProCite®, each professor now has a strong tool useful for generating personalized bibliographic lists. Finally, the *Répertoire* is also used by the Research and Innovation Directorate for internal management needs.

Journal Subscriptions Under the Microscope

In 2002 the Library undertook a major journal needs study. Several factors contributed to this decision: ten years of budget cuts and massive journal cancellations followed by a sudden government reinvestment in Quebec universities plus a rapid growth of electronic subscriptions through several "big deals" with major publishers. The Library wanted to identify gaps in the collection in order to eventually offer patrons access to those journals containing at least 80% of the articles published or cited by Polytechnique's faculty. The Library expected to verify Pareto's law: that a relatively small number of journals would satisfy most of its researcher's needs.

Following are an outline of the methodology, a summary of the results, plus a description of the follow-up action undertaken by the Library.

Three distinct studies were simultaneously conducted: one on faculty's published articles, one on articles cited by faculty in their own articles, and a study of articles requested via inter-library loan. Data sources consulted were respectively the *École's Répertoire des publications scientifiques et techniques*, the commercial database Web of Science®, and usage statistics from CISTI Source, the Library's main document supplier. Granted, such studies are not unusual in the library world. The originality of the Library's approach lies in combining the results of these three separate studies into a single set of results and then drawing meaningful conclusions.

Together, these three studies identified 3,872 journals of interest to the Library's patrons. For each study, a list of the top 20% journals – those containing the largest number of articles – was compiled. In each case, Pareto's law was, in fact, verified. The three lists thus obtained were combined into a single list of 1,067 journals considered to be of most importance for Polytechnique researchers.

At the time, the Library was already subscribing to 329 of these titles. Another 333 were about to become available as the Library was in the final stage of acquiring electronic collections from four key publishers. Together, these 662 journals contained 70% of the articles published or cited by Polytechnique's faculty and researchers. A question arose: which of the remaining 405 titles should be acquired in order to reach the 80% goal. A point system was thus devised taking into account the frequencies of publication, of citation and of document supply for each journal. With this system, the 81 titles with the highest scores were sufficient to increase the overall percentage to 83%, slightly in excess of the Library's goal. The annual cost of these 81 journals was estimated to be over \$125,000.

As well, approximately 90 existing subscriptions in the Library's collection were identified as being of little use and should therefore be cancelled. These cancellations would only make available some \$15,000.

These results formed the basis of the Library's "journal redeployment plan" submitted in 2004 to Polytechnique in support of budgetary demands. Polytechnique responded by giving the Library additional funds to implement this plan. At this writing, nearly half of the titles have been acquired. New demands will be submitted for the next budget year which may permit the Library to acquire most of the remaining titles.

At its inception, the journal needs study supported a clearly defined goal. The rigorous approach used relevant statistics and methodologies that were readily appreciated by an audience of engineers. These factors, we are convinced, contributed to the very positive response given to the Library's budget demands. It is noted, however, that the results of this study should not be slavishly followed as the development of the Library's collections must continue to provide for journals in emerging areas of study and to take into account other factors such as the prohibitive cost of certain journals.

Recent growth in the number of journal subscriptions.

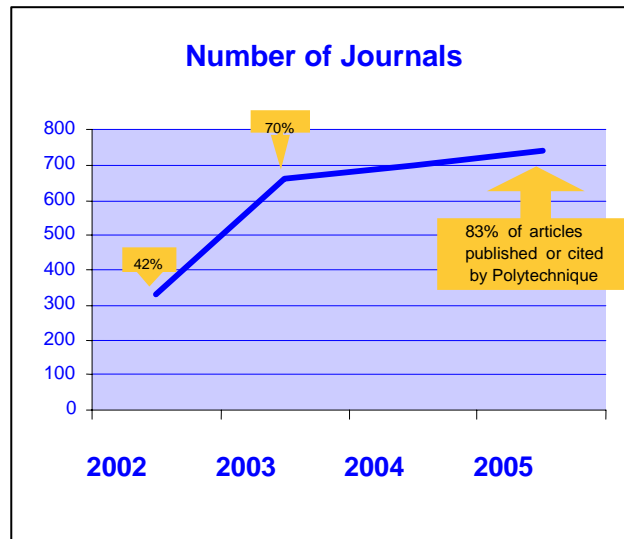


Figure 3.

Publication Analysis

The number of publications is an important indicator of an academic institution's output and the number of citations to these publications is an indicator of their impact. Any analysis dealing with publications necessarily involves a librarian's favourite tools, i.e. bibliographic and citation databases. It was therefore not surprising that Polytechnique asked its Library's assistance in developing a methodology for comparing publication data of fifteen major Canadian engineering schools. This assignment was part of a broader attempt by the Dean of Research and Innovation to compare the state of research at Ecole Polytechnique with the situation at its main competitors. The Library's challenge was to obtain publication data at the departmental level for each school - not an easy feat, considering the uncontrolled manner in which author affiliations are generally represented in articles and databases.

Data for the previous five-year period was obtained from Thomson ISI's Web of Science®, a major bibliographic source for peer-reviewed journals which, at the time, was the only extensive source for citation data. Searches were conducted in the Web of Science®'s address field where institutional names and a few keywords have been standardized by the vendor. The search strategy included the institution's name and the standard abbreviation ENGN (which is likely to occur in the name of an engineering department) or its French equivalent – the full word "GENIE". This strategy was tested for Polytechnique and the results retrieved were then matched to some 80% of the articles included in the *Répertoire*. It was concluded from this exercise that data would therefore be missing for all institutions since it either would not be indexed in the Web of Science® or because there would be insufficient information in the address field. However, it was felt that the sheer amount of data retrieved would prove sufficient to permit the emergence of clear trends.

For each article retrieved, the address field and the number of citations to that article were downloaded into an Excel spreadsheet. An address field can contain more than one address, including addresses of co-authors not belonging to the institutions under study. A major data cleansing activity was thus required to remove all addresses other than the desired fifteen engineering schools. From the remaining data, the departmental information was highlighted, then standardized using the current departments' names at each of the fifteen institutions. Only 10% of the addresses could not readily be matched to a department and were thus assigned a "miscellaneous" entry.

In addition to basic Excel skills, the processing of such large amounts of data required an in-depth knowledge of advanced functions such as filtering and array formulas. The lengthy data cleansing activity yielded over 15,000 usable addresses. This data set was sufficient to permit the preparation of tables detailing publication trends over five years for each institution and for each of its engineering departments. Other tables compared the output and citations of similarly-named departments; for example, ten of the fifteen schools have departments of chemical engineering.

List of tables produced.

	For each institution	
		For each department
Year by year		
Number of articles	X	X
Five-year period		
Number of articles	X	X
Number of citations	X	X
Citations per article	X	X
Number of full-time faculty	X	
Articles per faculty	X	
Citations per article	X	
Citations per full-time faculty	X	

Table 1.

The Library's report to the Dean contained many tables but little analysis. Despite this, Polytechnique's Dean of Research and Innovation and the Directors of its engineering departments have been using this data in conjunction with other data such as enrolment levels, grants, etc. in order to determine appropriate actions to ensure better positioning of École Polytechnique. The Library has now been tasked with updating the study on a yearly basis and to expand its scope to include major U.S. engineering schools and faculties.

Conclusion

While these five initiatives required a thorough utilization of the librarians' basic competencies, several complementary competencies were required to achieve these innovations. The ability of several teams to share common goals, their openmindedness and their audacity in moving into unfamiliar and uncharted territory also significantly contributed to the success of these initiatives.

Developed in close synergy with researchers, these initiatives positively influenced the perception of the Library within the Polytechnique community. In fact, these incursions into less-traditional fields were perceived as proof of the team's dynamism and resulted in higher visibility and a stronger, more strategic positioning for the Library within the institution. The proof is clear: between 1998 and 2004 the Library's budget rose 62.1% and the number of full-time staff went from 28.3 to 36.7.

Finally, these five initiatives permit the Library to prepare for the future. Due to its deeper understanding of its researchers' needs, the Library can effectively and successfully adapt its offerings to better serve its constituency.