Chemical Information Instruction in Academe: Recent and Current Trends

Arleen N. Somerville*

Carlson Library, University of Rochester, Rochester New York 14627-0236

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As a continuation in a series about chemical information instruction in academe, this article describes the results of the 1993 survey of information instruction activities in 390 United States chemistry departments conducted by the American Chemical Society (ACS) Division of Chemical Information's Education Committee and makes comparisons with the previous 1984 survey. Current trends, especially in rapidly changing chemical resources, are indentified and resulting implications for information instruction programs are discussed. Ways of overcoming increasing costs of information resources are offered, as well as suggestions for involving faculty and librarians as active supporters and participants in such programs.

INTRODUCTION

Chemists have long emphasized the importance of organizing information for ready retrieval, developing comprehensive indexes, and teaching students to learn how to use the wide ranging information sources. A 1985 article in this journal reviewed the previous 25 years of information instruction activities, noted guidance provided by the American Chemical Society (ACS) Committee on Professional Training (CPT), and offered suggestions for increasing instruction programs.[1] The ACS Division of Chemical Information established an Education Committee in 1983. One of its first projects was to conduct a survey in 1984 of many chemistry departments to determine what programs existed and what obstacles departments faced in implementing information instruction programs, so the Committee could address these concerns. The results of that survey (280 responses) were reported in this journal in an article that suggested ways in which departments could meet difficulties they faced in maintaining information instruction programs and challenged faculty, administrators, librarians, and the CPT to meet the CPT's information and library guidelines.[2]

1993 SURVEY

Another survey was conducted by the ACS Division of Chemical Information's Education Committee in 1993 of all chemistry departments listed in the 1991 CPT annual report.[3] The results provide an excellent snapshot of 390 departments' (65.5% of all departments) chemical information programs.[4] Eleven questions were asked about information instruction overall and computer searching and electronic sources, in particular. (See Appendix 1 for survey questions.) Survey results are summarized here.

Separate courses were offered by 41.5% or 162 schools, compared with 34% in 1984. These 162 schools included 60 BS-, 50 MS-, and 49 PhD-granting schools. The course was most likely to be required for undergraduates, especially juniors or seniors. Faculty usually taught these courses (i.e., in 98 of the schools). Librarians taught courses in 16 schools (most often in PhD-granting schools) and faculty/librarian teams taught the course in 22 schools. Instruction was integrated into one course by 34% (134) of the schools, whereas 42% (166) integrated instruction into two or more courses. The courses cited most often for both undergraduate and graduate students, in descending order, were: organic, seminar or independent study, inorganic, physical, analytical, biochemistry, and polymer. Faculty were also responsible for most information teaching when it was integrated into courses (i.e., in 72 schools). Librarians taught in 19 schools and joint faculty/librarian teams in 44 schools. Other forms of instruction included formal workshop or short course (10% of the schools, with librarians conducting 62% of the workshops) and informal dissemination by faculty (44%) and librarians (27%). In 17% or 66 schools, undergraduates and graduate students taught themselves by consulting documentation, using tutorials, etc. Only 3% or 12 schools said information searching was not taught in any course.

When asked what difficulties departments faced in providing information instruction, the top four difficulties remain the same as in 1984 and at very similar percentages:

difficulty	percentage
curriculum too crowded for a course	56
faculty too busy	38 (most common in BS schools)
no time available in courses	27
low faculty priority	21 (most common in PhD schools)
lack appropriate problem sets	19
faculty not feel qualified to teach	14
lack curriculum materials	12
librarians not available to teach	8 (30 schools)
librarians not feel qualified to teach	7 (29 schools; somewhat more common at BS schools)
Lack appropriate tests	7
low librarian priority	5 (21 schools)
librarian too busy	4 (15 schools)
other (e.g., scheduling difficulties institution networking limitations)	14 (45 schools)

Twenty-three percent (90 schools) said that (a) their curricula were too crowded AND (b) there was not time available in courses. (In 1984, 18% of schools felt that way.) Of the

* E-mail: asomerville@RCL.lib.rochester.edu. Fax: 716-473-1712.

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90 schools in the 1993 survey, 29 grant PhD degrees. These 29 represent 24% of the responding PhD schools. In addition, 15% (58 schools) said that (a) their curriculum was too crowded, (b) there was no time available in courses, and (c) faculty are too committed to other teaching responsibilities. Sixteen of these 58 schools grant PhD degrees. This low priority and efforts assigned to information instruction by schools, especially PhD-granting schools, is not advisable. Not only are students not learning to acquire information efficiently, which would help them be more productive chemists on the job, but the future professors are less likely to provide crucial information information skills to *their* students.

The survey asked about access to major chemistry reference sources because availability can affect the extent and quality of information instruction programs. In 1993, only 70% of respondants subscribed to print *Chemical Abstracts* (*CA*): 55% of BS schools, 77% of MS schools, and 91% of Ph.D. schools. Far fewer schools have the last two 5-year Collective Indexes (CI) to *CA* in print: 53% own the 1948–86 CI and 42% own the 1987–91 CI. In addition to *CA*, the following reference sources were surveyed:

source	print	online	CD	online catalog
Dictionary of Organic Compounds	68%	9%	1%	0%
Beilstein	61%	28%	4%	2%
Science Citation Index	49%	27%	15%	2%
Kirk Othmer *Encyclopedia of Chemical Technology*	49%	12%	1%	1%
Current Contents: Physical Sciences...	48%	11%	15%	4%
Gmelin	33%	19%		1%
Landolt-Boernstein	26%			
Index Chemicus	12%			
Current Chemical Reactions	10%			

Of these resources, many schools did not have regular access to basic sources that all schools that offer a BS degree should have. *Dictionary of Organic Compounds* is only available in print in 68% of schools and only used by 10% of schools via online or CD. *Science Citation Index*, with its unique and valuable citation index feature and interdisciplinary coverage, was only available in print in 49% of schools and used by only 43% of schools via online or CD.

COMPUTER SEARCH INSTRUCTION

Because of increased reliance on nonprint sources, schools were asked if students were taught to search chemical databases via computer or CD-ROM. Only 81% of respondants said yes; 17% said no. Those taught to search computer databases included:

group	percentage
undergraduates	89 (of all schools)
graduate students	70 (of the responding PhD schools)
faculty	38 (but, faculty conduct searches in 80% of schools)
other researchers	17

Who conducted searches (as a percentage of schools that teach online searching):

group	1984	1993
undergraduates		60%
graduate students		74% of PhD schools
students (no differentiation)	21%	
faculty	37%	80%
other researchers	7%	34%
librarians	62%	59%

There was a significant increase in searching by students and faculty between 1984 and 1993. The decrease in percentage of librarians is probably because of the 1993 inclusion of more smaller schools, which are less likely to have science librarians.

How was training accomplished for both individuals who are learning and trainers:

method	trainers	learners
colleagues/self-taught	49%	35%
DIALOG or STN workshops	30%	4%
Chemical Abstracts workshop	16%	2%
other database producers	6%	1%
local training	7%	20%

Half of the trainers were self-taught or learned from colleagues. Self-teaching was used twice as often as learning from a colleague. Self-teaching is not an effective learning technique for trainers. Learning from a colleague is a common technique in laboratories, but it is not optimal for information trainers to rely on that technique. Misinformation and a lack of information is proliferated through these techniques. Only 30% of trainers attended DIALOG or STN workshops, and only 22% attended database producers workshops. Again, this lack of formal instruction for trainers generally produces inadequate training. Learners were more often self-taught or learned from a colleague, although local training occurred in 20% of schools. Learners were not likely to attend workshops by vendors or database producers. Do these learners search effectively – to get reliable results for lab and research decisions? Very much depends on the quality of local training and commitment of the learners.

How student training for computer searching was paid for:

source of payment	undergraduate	graduate students
chemistry dept	41%	52% of the PhD schools
library	36%	38%
research grants	6%	24%
college	4%	2%
individual	2%	3%
special grants	3%	0%
other	3%	3%

Chemistry departments and libraries most often paid the cost of computer search training for undergraduates and graduate students, whereas more training was charged to research grants for graduate students.

How searches were paid for after training was completed:

source of payment	undergraduates	graduate students
chemistry dept	40%	50% of the PhD schools
library	35%	33%
research grant	18%	56% of the PhD schools
individual	10%	18%
college	4%	2%
combination	3%	4%
special grant	2%	2%

Chemistry departments and libraries funded continued searching for both undergraduate and graduate students, to a large degree.

Which databases were taught

database	online	CD-ROM
Chemical Abstracts	79%	2.5%
Registry File	49%	1.0%
Science Citation Index	17%	15.0%
Beilstein	17%	2.0%
Chemname	13%	
Medline	11%	7.3%
CASREACT	5%	
Gmelin	5%	
Learning files	10%	
other databases	19%	8.2%

The other databases taught included, for example, *Applied Science & Technology Index*, *Engineering Index*, *General Science Index*, *BIOSIS*, *Current Contents*, and *CARL Uncover*. Only 79% of schools taught computer searching of *Chemical Abstracts* and only 49% and 13% taught use of the Registry and Chemname files, respectively. The CD-ROM version of *Science Citation Index* was taught in 15% of schools, in addition to the 17% who taught online versions. From these percentages, it is obvious that only small numbers of schools teach these databases. Considering the lack of print resources and subsequent reliance on computer and CD-ROM formats in many schools, these low instruction percentages mean that many students did not learn to search the major resources.

Problems or difficulties faced by departments in providing online training programs included:

problem	percentage
faculty lack time	65
lack funds for regular searching	54
lack funds for online practice	51
lack ready access to equipment	33
lack funds for demos	25
lack teaching material	23
librarian lack time	21
lack funds for trainer's ongoing practice	19
lack funds to purchase teaching material	18
lack up-to-date equipment	17
lack funds for trainer training	17
lack funds for lecture preparation	8

As in the 1984 survey, problems cluster around four areas: faculty time and support, funding, teaching materials, and equipment.

One way that schools coped with inadequate funds was to attempt to control costs of online searching. Some methods listed are more likely to control costs than others. These methods, however, generally result in students having limited access to information sources. Those noted by respondants included:

method	percentage
searches approved by instructor or librarian	68
limited to a specific project or assignment	23
sign-up or log sheets	17
use software which identifies user	16
searches done by team of students	5
students pay percentage of search costs	4
students given set dollar amount per given time period	4
other (frequently faculty or librarian are present to aid searching and control costs)	21

Other ways to access chemical electronic resources began to be tapped based on the answers to the question that asked about use of other electronic resources and methods. A few schools used GenBank, Brookhaven Protein Databank, and Cambridge Crystallographic databases. Many schools noted that BITNET and Internet were becoming available, although the use was somewhat limited as determined from the nonspecific references to Internet.

CPT ACTIVITIES SINCE 1992

In 1992, the CPT updated its *Guidelines and Evaluation Procedures*.[5] The "Chemical Literature and Information Retrieval" section specified that "Students preparing for professional work in chemistry must learn how to retrieve specific information from the enormous and rapidly expanding chemical literature." In fact, "The complexity of this task is such that one can no longer easily acquire the necessary skills without some formal instruction." This instruction should "include an understanding of the use of *Chemical Abstracts*, *Beilstein*, *Gmelin*, *Science Citation Index*, and other compilations, such as *Landolt-Bornstein*..." Also, "It is highly desirable that students gain some experience with online interactive computer files, and it is essential that students understand the organization and use of printed information sources in order to employ the computer-readable files to best advantage." The "Library Requirements" section noted that "Essential to an approved chemistry program is a good library where faculty and students have access to books and periodicals and where adequate support for database searching is available. *Chemical Abstracts* (hard copy or online) must be a part of the collection. ... The department meets the minimum library requirement for approval if its library subscribes to twenty or more refereed journals in the chemical sciences and has a range of other reference materials. If an institution subscribes to fewer than twenty current refereed journals in the chemical sciences it must demonstrate that an adequate mechanism exists for faculty and students to gain access to the wider literature." At a later point the number of journals was reduced to fourteen and a list of recommended journals was published separately in the Fall 1992 *CPT Newsletter* (p 7) and is available at its Web site.[6] This list will be reviewed in 1998; the new list will appear on the Web. The "Financial Support" section of the 1992 guidelines specifies that it is necessary that local institution support include "a suitable amount and variety of library and learning resources, including chemical research periodicals, reference materials, and database searching facilities."

In recent years it has become increasingly difficult for academic institutions, especially schools that do not offer PhD degrees, to meet these 1992 guidelines. Significant costs of journals, reference sets, and indexes have led to extensive cancellation of print versions with varying access to electronic formats. A few database producers and vendors have offered reduced rates for print and electronic access, but often costs remain beyond many schools' budgets. In 1998, the 23 highly recommended titles cost approximately $38 000. It is impossible for schools to meet the CPT guidelines if they cannot acquire the information resources that need to be taught. CPT is aware of these issues and plans to discuss them soon. One potentially valuable process would be to have discussions between CPT, the chemical information community (ACS Division of Chemical Information's Education Committee), the chemical education community (ACS Division of Chemical Education and the ACS Society Committee on Education), the chemical publishing community (ACS Joint Board/Council Committee on Chemical Abstracts Service, ACS Joint Board/Council Committee on Publications, ACS Governing Board for Publishing, and other major commercial publishers of chemical publications), and the chemical industry (ACS Corporation Associates). Background documents would include information about CPT guidelines and necessary information searching skills, as well as constraints experienced by each group. Such discussions would seek to identify ways to enable schools to acquire information resources on which to build information instruction programs.

CURRENT TRENDS

Continuing changes in chemical resources and resulting implications were discussed in a 1997 article,[7] but more changes have occurred in the past several years. These changes are evidence of the constant and even accelerating changes in chemical information resources that occur today and affect librarians' and chemists' abilities to stay current, search efficiently, and teach searching skills effectively. A brief description of major changes in resources demonstrates the wide-ranging impact on chemical information.

1. Information sources increasingly available electronically.

2. Sources are sometimes available in more than one electronic format; for example, *Chemical Abstracts* is available from STN International (both via Messenger command searching and via STNEasy on the web), CD-ROM (as a complete database and in subsets as *CASurveyor*), and as *SciFinder* or *SciFinder Scholar*. With new electronic formats appearing with increasing frequency, searchers constantly face new choices.

3. Enhanced searching of electronic databases with more sophisticated ways of manipulating information. Newer options include searching, manipulating, and analyzing large textual resources, as well as searching collections of chemical structures, property data, chemical reactions, and sequence data.

4. Constant vigilance needed to stay current with newly available options and their changing cost, coverage, and searching features. Hints on how faculty and other researchers can stay current are found in the Carr and Somerville article.[7] For information specialists, this is an integral and time-consuming part of the job.

5. Increased emphasis on providing access to resources at the desktop is common, rather than requiring that students and faculty come to the library.

6. Increasing options for current awareness programs from a wider range of sources and various electronic formats − newer services (UnCover Reveal); Web pages of most publishers; secondary services such as Institute of Scientific Information and Chemical Abstracts Service; and Web sites (such as BioMedNet).[8]

7. Significant and increasing impact of the Internet and the WWW. (a) It is common for students to assume that all information they need is available on the Web. Although information on the Web is increasing and some organization of the information is occurring, there is a vast amount of valuable information available in print and electronically from resources not on the Web. Students need to learn about the availability of all resources and how to use them effectively. (b) Because Web searching appears so easy, many students assume they know how to find information and do not take the time to learn to search effectively. Even with the Web, some instruction is useful. (c) This attitude that searching for information is easy carries over to searches of more complex chemical databases. Here, some tips are useful even if searching appears simple on the surface.

8. Increasing availability of US patents via the Web, so their coverage in instruction is more likely.

9. Increasing cost of information resources − both print and electronic. Subscriptions to print journals often increase ∼10−12% each year. Electronic journal subscriptions vary widely, from ∼10% additional cost of the print subscription to double the cost. Current costs of electronic counterparts are usually higher without a print subscription. There are, however, a few publishers who have begun to price electronic journals as the base cost and reduce the cost of print subscriptions. Print and electronic versions of chemical indexes, abstracts, and reference sets are usually large, complex, and costly to produce, and hence carry a high price. Yet, the academic market is hard pressed to afford these prices, because the user base is often a small segment of the overall school community, even when related scientific subjects are included. Therefore, high costs are hard to justify and can be impossible to fund. As a result, there is an increasing differential between schools that can afford access to the wide spectrum of chemical information databases, and those that cannot. Even large research universities have difficulty acquiring subscriptions, and 4-year and masters degrees colleges often cannot afford them. Sometimes consortia offer access to databases that a school on its own could not afford. (state-wide systems; e.g., California, Illinois, Ohio, Texas, and other groups, e.g.; NERL − Northeast Research Libraries).

10. Libraries' greater emphasis on offering access to journal articles, rather than ownership, due to lack of funds for subscriptions in any format.

11. Increased availability of full text of journal articles on the Web: from journal publishers; secondary publishers (Institute for Scientific Information); joint primary and secondary publishers (e.g., ChemPort, from American Chemical Society/Chemical Abstracts Service, which includes journals from other publishers); and aggregators of journals from many publishers (e.g., Electronic Collections Online (ECO) from OCLC).

12. Gradual shift of publishers' emphasis from journal subscriptions to delivery of single articles on request.

13. Increased flexibility and searching capabilities of journal articles and other Web resources. Features include searching full text, displaying and manipulating graphics that are increasingly in color, links to other journal articles, links to indexing references, and tables of contents of future issues. Some journals are only available via the Web, whereas many are offered in both print and on the web.

14. Introduction of journals that permit interactive communication between authors and readers and end user customization.[9]

15. Increased use of database management applications, such as EndNote, ProCite, and Reference Manager, to create a searchable personal database.

16. Changes in role of information specialist. There is a significantly increased educational role, with less intermediary work.

17. Additional copyright issues in the electronic and especially Web environment.

18. Increased interest by universities in publishing journals on their Web sites, making theses and dissertations available via their Web sites, and encouraging faculty to retain copyright.

COPING WITH CURRENT TRENDS

In 1993, the four primary areas of difficulty faced by chemistry departments in providing information instruction were the same as in 1984: funding, faculty support and involvement, curricular materials, and librarian support and involvement. Funding for access to journals, reference sets, and indexes continues to limit student exposure to chemical literature in many schools. Library consortia offer some access possibilities, which librarians should pursue assertively. Creative ways of bringing electronic access to schools should be actively supported by publishers and vendors. An example is Project UCAIR, which seeks to extend electronic access to *Chemical Abstracts* and other resources to undergraduate schools.[10] Continual discussions between the chemical education, information, publishing, and industrial communities are essential to help schools provide access to information resources on which to base effective information instruction programs. Although the Web will offer increasingly valuable and organized information, the vast amount of valuable information found in reference sets and indexes should not be ignored.

In 1993, faculty support and involvement was often lacking. Faculty felt they lacked time, did not give information instruction high priority, claimed courses lacked time to include information instruction, or did not feel qualified to teach (especially online searching). However, faculty support and involvement is critical in developing and maintaining an effective program. Doubting faculty need to recognize that information searching is part of chemical literacy − to become a productive chemist includes being a knowledgeable information searcher. A variety of opportunities exist to convince faculty to support such programs. Many of these reasons were discussed in a 1997 article by Somerville and Carr.[11] These include, for example, industry's requirement that chemists be able to find information efficiently, the emphasis on lifetime learning, and graduates' increased job opportunities. As faculty recognize that they are not able to stay current with the constantly changing electronic formats and they see the need to teach students about resources, they become much more willing to welcome librarians' teaching initiatives.[11]

CURRICULAR MATERIALS: CHANGING INFORMATION RESOURCES

The 1997 article by Carr and Somerville defines the basic information searching skills that undergraduate and graduate students should acquire.[7] That article, and others[11,12] list curricular materials available for potential instructors. New in the past few years is the excellent and comprehensive CHEMINFO (Chemical Information Resources) compiled and maintained by Gary Wiggins at Indiana University.[13] This resource also lists information courses with web pages and links to the Clearinghouse for Chemical Information Curriculum (also maintained at Indiana University) and the ACS Division of Chemical Information's Education Committee. While an occasional new text is published about chemical information,[14] Web teaching aids, such as CHEMINFO, have increased significantly and are a primary resource. The chemical information listserv[15] is a major source for staying current on resources (new ones, new formats, price changes, etc.) and workshops about using and teaching information, as well as getting good quality responses to questions. Organizations such as Chemical Abstracts Service and Beilstein's CrossFire provide information for instruction on the Web. CAS publishes searching manuals (Using CAS Databases on STN; Using the CAS Registry File on STN − Chemical name and molecular formula searching; Structure Searching in The CAS Registry File; Practice Problems for Basic Structure Searching) and aids for teaching (e.g., Searching Tips and FAQ for SciFinder Scholar) on its continually expanding Academic Page.[16] The Beilstein CrossFire Web site[17] provides links to several libraries with instruction information on their web pages. "The Chemical Information Instructor" column of *Journal of Chemical Education* updates bibliographies of teaching resources available on a regular basis and publishes articles that offer practical information about teaching resources and techniques.[18]

LIBRARIANS' ROLES

Librarians have increasing responsibilities vital to aiding information instruction. This is discussed extensively in several articles published in Chemical Librarianship: Challenges and Opportunities.[19] Many factors promote and support this involvement.

1. Librarians are in the best position to stay current with new and changing electronic resources.

2. Librarians' involvement in consortial discussions and in decisions about subscriptions to groups of journals affect electronic resources available.

3. Librarians can evaluate resources for potential value to their faculty, students, and other researchers. The close communication that this requires between faculty and librarians aids librarians' understanding of the school's education and research programs.

4. Librarians have significant responsibilities for marketing new resources and for training faculty, students, and other researchers.

5. Librarians have become more active in talking and working with publishers as individuals and via various consortia to increase mutual understanding and influence pricing.

SUMMARY

The 1993 survey of chemical information instruction programs in United States chemistry departments revealed the limited access to print and electronic information resources available in libraries, the need for increased involvement by faculty and librarians, and the need for curricular materials. The funding crisis has been exacerbated by recently accelerating costs of electronic resources, as noted in the list of current trends. These publishing and related trends offer librarians opportunities to take initiatives in identifying resources useful to their students and researchers, marketing and teaching their use, and influencing funding options with publishers. Factors such as the increasing frequency of changes in format of major resources may result in more faculty being willing to work with librarians in teaching information, although more work is needed to convince some faculty that information searching skills are an essential part of chemical literacy. Funding of access to information resources and a mutual understanding of issues from different perspectives may increase the extent of information instruction. Joint discussions between the ACS CPT, the chemical information and education communities, industrial representatives, and publishers may help schools graduate chemistry students who are knowledgeable information searchers and lifetime learners.

APPENDIX 1. CHEMICAL INFORMATION INSTRUCTION IN UNITED STATES COLLEGES AND UNIVERSITIES

Please complete this form **by February 28, 1993.**

I. How does your Department currently teach chemical information? (Please check all that apply)

A. 162 Separate for-credit course
1. required? Yes 106 ; No 55
2. if required, for whom?
1 a. freshmen
7 b. sophomore
72 c. junior
50 d. senior
2 e. graduate student

3. Taught during 1991/92 year? 118 yes; 24 no.
If no, when taught last?_____

4. Taught by:
102 a. faculty 24 c. jointly taught by faculty & librarian 16 b. librarian 0 d. other (please specify) ______________

B. 134 Taught within framework of one lecture or lab course.
1. which course

	Undergraduate	Graduate student
36 a. organic chemistry	32	4
10 b. analytic chemistry	5	5
10 c. inorganic chemistry	8	2
19 d. physical chemistry	16	3
8 e. biochemistry	5	3
4 f. polymer chemistry	2	2
52 g seminar	38	14
41 h. others (please specify)		
______________		
______________		

2. who teaches the information instruction?
75 a. faculty 46 c. jointly taught by faculty & librarian
19 b. librarian 0 d. other (please specify) _______________

C. 166 Taught within framework of 2 or more lecture or lab courses.
1. which courses:

	Undergraduate	Graduate student
113 a. organic chemistry	95	18
49 b. analytic chemistry	38	11
69 c. inorganic chemistry	53	16
69 d. physical chemistry	57	12
41 e. biochemistry	35	6
13 f. polymer chemistry	9	4
80 g seminar	60	20
71 h. others (please specify)	58	13
______________		
______________		

2. who teaches:
125 a. faculty 38 c. jointly taught by faculty & librarian
14 b. librarian 4 d. other (please specify) ______________

D. 40 Formal workshop or short course
1. who attends:
20 a. undergraduates 29 b. graduate students
2. who teaches:
7 a. faculty 5 c. jointly taught by faculty & librarian
25 b. librarian 3 d online system or publisher
1 e. other (please specify)____

E. 12 Not taught in any course.

F. 173 Informal dissemination by faculty.
1. to whom:
152 a. Undergraduates 93 b. Graduate students

G. 107 Informal dissemination by librarian.
1. to whom:
100 a. Undergraduates 60 b. Graduate students

H. 66 Self taught (using documentation, tutorials, etc)
1. for whom:
57 a. Undergraduates 42 b. Graduate students

II. What problems/difficulties have your department faced in providing chemical information instruction? (please check all that apply)
219 A. curriculum too crowded for a separate course
107 B. no time available within courses
46 C. lack curriculum materials:
what topics? (please specify)______________________
____
75 D lack appropriate problem sets
28 E. lack appropriate tests
what topics? (please specify)__________________________
____
151 F. faculty too heavily committed to other teaching responsibilities
53 G. faculty do not feel qualified to teach
84 H. low faculty priority
30 I. librarian unavailable for teaching
15 J. librarian too busy
29 K. librarian does not feel qualified to teach
21 M. low librarian priority
49 N. other (please specify) _____________________________________
____

III. Are students taught to search chemical databases using computer and/or CD-ROM?
A. Yes 316 No 66

B. If yes, who is taught (check all that apply):
281 1. undergraduates 121 3 faculty
131 2. graduate students 53 4 other research staff

C. Which databases:

	Online (STN, Dialog, etc.)	CD-ROM/ disks
____1. Chemical Abstracts	248	8
____2. Registry File (STN)	155	3
____3. Chemname (Dialog)	40	1
____4. Beilstein	52	6
____5. Gmelin	16	1
____6. Science Citation Index	54	46
____7. Medline	36	23
____8. CASREACT	17	1
____9. Learning files (please specify)	30	4
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______________		
______________		
____10. Others (please specify)	19	26
______________		
______________		
______________		
______________		

IV. How is student training for computer searching paid for?

	Undergraduates	Graduate students
_____A. by department of chemistry	131	68
_____B. by library	114	50
_____C. by college	14	3
____ D. by individual	7	4
_____E. by research grants	18	32
_____F. by special grants (please specify)	3	0
______________		
______________		
_____G. other (please specify)	5	4
______________		
______________		

V. How are computer searches paid for (after training is completed):

	Undergraduates	Graduate students
____ A. by department of chemistry	127	74
____ B. by library	112	44
____ C. by college	12	3
____ D. by individual	30	24
____ E. by research grant	56	74
____ F. by special grant	5	3
____ G. by combination of (please specify)	9	5

____ H. other (please specify)	1	1

VI. Who conducts searches of computerized databases? (please check all that apply)
235 A. undergraduates 312 D. faculty
149 B. graduate students 69 E.other researchers
230 C.librarian

VII. How are costs controlled/managed when students (undergraduates or graduate students) do own computer searches? (Please check all that apply)
52 A. use software which identifies user
216 B. searches must be approved by instructor/advisor/librarian
56 C. sign-up/log sheets
14 D.. students pay percentage of search costs
14 E. student is given set dollar amount per given time period
25 F. student is limited to a specific length of time online
74 G. limited to a specific project/assignment
16 H. searches done by a team of students
67 I. other (please specify) ____________________________

VIII. How is training accomplished:

	For Trainers	For Learners
____ A. CAS workshop	52	8
____ B. Dialog Workshop	40	3
____ C. STN Workshop	54	10
____ D. by producer of database	20	4
____ E. by colleague or mentor	58	97
____ F. self taught	97	44
____ G. locally produced manuals	11	32
____ H. local workshop	12	31
____ I. library school course	3	5
____ J. other (please specify)	14	38

IX. What problems/difficulties has your department faced in providing online training programs.
205 A. faculty lack time
65 B. librarian lack time
79 C. lack money for demos
160 D. lack money for online practice for students
169 E. lack money for regular searching by students
105 F. lack ready access to equipment
71 G. lack teaching material
58 H. lack money for purchasing teaching material
26 I. lack money for lecture preparation
55 J. lack money for instructor training
60 K. lack money for instructor's on-going practice
56 L. lack up-to-date equipment
45 M. other (please specify)____________________________

X. Does your Library have a current subscription to printed CA. 275 Yes 89 No

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B. Beilstein	236	15	109	5
C. Gmelin	129	1	62	4
D. Landolt-Bornstein	100	1	17	4
E. Dictionary of Organic Compounds	267	2	34	3
F. Science Citation Index	189	59	105	7
G. Current Contents-Physical, Chemical, & Earth Sciences	188	57	43	15
H. Index Chemicus	45	1	7	3
I. Current Chemical Reactions	39	0	8	3
J. Kirk Othmer Encyclopedia of Chemical Technology	191	4	45	5

XII. Please list additional chemistry-related electronic resources that are accessible from your institution.
Name and format (i.e., online catalog, CD-ROM, Department server, Internet, etc.)

XIII. List full names of faculty most interested in chemical information instruction.

XIV. List name of chemistry librarian, or librarian with primary responsibility for chemistry, and state title and address.

XV. Additional comments are most welcomed. (Please use back of sheet, if needed)

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(3) CPT 1991 Annual Report. *Chem. Eng. News*, **May 18, 1992**, *70*, 30−36.

(4) The Committee sent surveys to all 595 schools that granted certified and noncertified chemistry degrees in 1991. The 390 respondents included 185 BS-, 84 MS-, and 121 PhD-granting schools. Committee members in 1993 included Grace Baysinger (Stanford University), Dr. Robert Buntrock (AMOCO), Carol Carr (University of Pennsylvania), James Heinis (University of North Carolina, Chapel Hill), Charles Huber (University of California, Santa Barbara), Maggie Johnson (University of Kentucky), Dr. Adrienne Kozlowski (Central Connecticut State University), Mary Ann Palma (DIALOG), Dr. Allan Smith (Drexel University), Arleen N. Somerville (University of Rochester), Sherri Wilhite (University of California, San Diego), and Dr. Samuel Wilen (City University of New York).

(5) Available at http://www.acs.org/cpt/hp.htm or write for a free copy to: Secretary, Committee on Professional Training, American Chemical Society, 1155 16th Street NW, Washington, DC 20036. Tel: 202/872−454589; Fax: 202-872-6066; e-mail: can98@cas.org.

(6) http://www.acs.org/cpt/library.htm.

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(8) Uncover is available at http://www.carl.org/; BioMedNet is available at http://biomednet.com/.

(9) *The Internet Journal of Chemistry*. Available at http://www.ijc.com.

(10) Project UCAIR − Undergraduate Cooperative Access to Information Resources. Project Director is Dr. R. G. Landolt, Professor of Chemistry, Texas Wesleyan University, 1201 Wesleyan Street, Fort Worth, TX 76105-1536. E-mail: landoltr@txwes.edu.

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