the material and complete the problems at their own convenience. Only occasional lectures were scheduled for the purpose of discussion of problems and presentation of supplementary material.

Mention should be made of some of the alternative approaches that have been taken to the training of individuals in the use of library materials. At Southern Illinois University, the freshman orientation to the library is provided by means of a "teaching machine."[4] The visual display of library materials is incorporated into a written (or audio) programmed instructional system. Occasionally the programmed learning is reinforced by requesting the student to leave the console and locate information manually in specific library sources, such as the card catalog. With the recent availability of computers designed for instructional purposes, the programmed approach could be employed very effectively in the training of students in the use of the chemical literature. Preliminary plans have been made to incorporate some of the contents of the A/V Guide into the CAI system at the University of Texas at Austin. The CAI system will involve the use of computer instruction and testing in conjunction with components of the audio-visual approach discussed in this paper.

The use of written programmed materials for instruction in chemical literature has not received much attention, except as it relates to chemical nomenclature. However, an excellent programmed guide to the Beilstein treatise is available.[5] It may be hoped that the development of CAI and written programs in chemical literature will stimulate a greater concern on the part of information specialists with some of the usual and frequent difficulties students have in the use of chemical publications.

ACKNOWLEDGMENT

The financial support of the Esso Education Foundation in this project is gratefully acknowledged. The photographic work was done by Walter Wager (of the Audio-Visual Center at E. Michigan University) and George Griswold (Washtenaw Community College). The services provided by Richard Oltmanns and the staff of the Audio-Visual Center at E. Michigan University is also gratefully acknowledged.

LITERATURE CITED

(1) Mellon, M. G., *J. Chem. Ed.* **38**, 273 (1961).
(2) Martin, D. F., and D. E. Robison, J. CHEM. DOC. **9**, 95 (1969).
(3) Mellon, M. G., "Chemical Publications, Their Nature and Use," 4th ed., McGraw-Hill, New York, 1965.
(4) Wendt, P. R., and G. C. Rust, "A Study to Determine the Extent to Which Instruction to University Freshmen in the Use of the University Library can be Turned over to Teaching Machines," So. Ill. Univ., Carbondale, Ill., 1963, Final report of research conducted under U.S.O.E. Grant No. 7-11-076.00, Title VII of Public Law 85-864.
(5) Runquist, O., "A Programmed Guide to Beilstein's Handbuch," Burgess Publ. Co., Minneapolis, Minn., 1966.

Who's Teaching Chemical Literature Courses These Days?*

DEAN F. MARTIN and DENNIS E. ROBISON
University of South Florida, Tampa, Fla. 33620

Received December 27, 1968

This paper reports the results of a survey of the status of chemical literature teaching practices in 259 U.S. chemistry departments with graduate programs. A 90% useful response was obtained in the survey. About 40% of the responding institutions offered a formal chemical literature course. A profile of the course is given. At the remaining institutions, chemical literature is taught by a variety of methods and is integrated in other courses. The teaching emphasizes use of periodicals, indexes, monographs, government documents, and patents in order of decreasing priority. As measured by weighted priority means, the emphasis is comparable at schools with or without formal courses in chemical literature. A small decline in the number of chemical literature courses is ascribed to a faculty preference for integration of chemical literature in other courses or a belief that chemical literature is less important than other courses.

All chemists would agree that a chemistry major should acquire knowledge of the nature of the major kinds of primary and secondary sources, as well as have experience and proficiency in using as many as possible. How this worthy objective is achieved is subject to a variety of opinions. It may well be that the method of achieving this objective is not of primary importance. It does seem important to learn what methods members of our profession are using. This information would be of mutual benefit.

Accordingly, we have undertaken a survey on the status of the teaching of chemical literature. The last such survey was undertaken by a joint committee of the Divisions of Chemical Literature and Chemical Education, under the chairmanship of Professor M. G. Mellon.[7,8] The present

*Presented before the Symposium on Training Chemists in the Use of the Chemical Literature, Division of Chemical Literature, 156th Meeting, ACS, Atlantic City, N. J., Sept. 8–13, 1968.

Table I. Status of Instruction in Chemical Literature, 1960–1967

Nature of Instruction	Institutions Granting Ph.D. Number	%	Institutions Granting M.A. or M.S. Number	%
By means of formal course	60	38.9	33	44.0
a. During entire period	47		27	
b. Dropped during 1960–1967	13		6	
Without a formal course	97	61.1	42	56.0

report summarizes the results of a questionnaire which was sent in September 1967, to those schools having a graduate program in chemistry.

SELECTION AND RESPONSE

Questionnaires were sent to heads of chemistry departments which offered a graduate degree, either at the masters or doctorate level. The schools were selected from two lists: the ACS Directory of Graduate Research[2] and the College Blue Book.[4]

The response was excellent. The data that follow constitute a 90% useful response to the 259 questionnaires that were mailed. Fourteen questionnaires (5%) were unsuitable. The response was 157 (out of 174) and 75 (out of 85) from institutions granting the Ph.D. and master's degree, respectively, as the highest degree.

STATUS OF INSTRUCTION

The data in Table I indicate that about 40% of the responding surveyed departments offered a formal course in the use of the chemical literature. Our results indicate that a number of institutions dropped the formal course, as a method of instruction, during the period surveyed, 1960–1967. The reasons given are summarized in Table II.

Those who do offer a formal course in chemical literature were asked to give their reasons. Their responses are summarized in Table III. Our survey did not reveal any obvious correlation between the availability of a formal course and the size of the department.

Apparently, the major reason for not offering a formal chemical literature course is a preference among the instructional staff for integration of chemical literature within other courses (Ph.D. institutions, 46%; master's institutions, 53%). Another significant reason, particularly at Ph.D.-granting institutions, seems to be the belief that the formal course is less important than other courses required to train the professional chemist.

There are several reasons for the latter view. Certainly, it must be recognized that there are many courses competing for the students' time. Also, there appears to be an ever-increasing volume of information that must be compressed into various courses. In view of this problem, we wondered how effectively chemical literature is integrated into various courses, and, of course, we wondered about the content of the formal courses. These points are covered in the next two sections.

CHARACTERISTICS OF THE FORMAL COURSES

We are able to draw a profile of a typical course, using the data summarized in Table IV. Typically, the course is required, or if not required it is recommended. The course is offered for one- or two-semester credit hours, or the quarter-hour equivalent. Few schools offer no-credit courses, and longer courses involve related material (technical writing, history, etc.). The enrollment is moderate, probably an average of 20 students. The course is taught by a chemist, occasionally by a librarian (at Ph.D.-granting institutions). Typically, the prerequisites are advanced standing. A foreign language requirement, surprisingly, is not typical.

Most students recognize the value of the course. Though many lament the difficulty of the course, few are apathetic. Typically, a textbook is used, as indicated in Table V.

The content of the course was indicated by priority listing on a scale of 1 to 5 (1, highest; 5, lowest). The responses were converted to a weighted priority mean using the formula (Equation 1):

$$\text{Weighted priority mean} = \Sigma n\ (N_r/N_t) \qquad (1)$$

where n is the priority scale number (1 to 5), N_r is the number of responses for the given priority, and N_t is the total number of responses. The results listed in Table VI indicate that the majority priority items are coverage of the periodicals, followed by indexes and monographs. Interestingly enough, usage of the patent literature received a low priority rating of 4, as did government reports. It is also a matter of some interest that the weighted priority means for two groups of institutions are remarkably similar for most items.

Table II. Reasons Given for Dropping a Formal Course of Instruction

Reason	Institutions Granting Ph.D. Number	%	Institutions Granting M.A. or M.S. Number	%
Library facilities inadequate	0		0	
Insufficient personnel	1.5[a]	11	0	
Integration of material in courses preferred	7	54	5.5	92
Too few majors to justify	0		0	
Less important than other course	3.5	27	0.5	8

[a] Fractional values indicate multiple choices. If two reasons were given, each was scored 0.5.

Table III. Reasons Given for Not Offering a Formal Course in Chemical Literature

Reason	Institutions Granting Ph.D. Number	%	Institutions Granting M.A. or M.S. Number	%
Library facilities inadequate	4	3	0	
Insufficient personnel	9	8	7	15
Integration of material in other courses preferred	52	46	25	53
Too few majors to justify	8	7	4	9
Considered less important than other courses	37	33	9	19
Other	3	3	2	4

Table IV. Formal Course Characteristics

Characteristic	Institutions Granting Ph.D. Number	%	Institutions Granting M.A. or M.S. Number	%
Required course				
Yes	38	63	15	46
No	13	22	7	21
No, but recommended	7	12	11	33
No response	2	3	0	0
Semester hours				
0	1	2	1	3
1	35	58	16	49
2	13	22	10	30
3	3	5	1	3
Other	8	13	5	15
No response	0	0	0	0
Average number of students/class/year				
10–20	29	48	20	61
20–30	14	23	1	3
30–40	2	3	0	0
40–50	3	5	0	0
Other	8	13	6	18
No response	4	7	6	18
Prerequisite				
None	8	13	4	12
Jr. or Sr. standing	26	41	18	55
Jr. or Sr. & language	15	24	3	9
Phys. chem.	4	6	3	9
Other	10	16	3	9
No response	0	0	2	6
Taught by				
Chemist	52	86	32	97
Librarian	7	12	1	3
Scientist not a chemist	1	2	0	0
Lively interest	7	12	5	15
Value recognized, difficulty lamented	21	35	13	39
Apathetic	6	10	1	3
Other	4	6	1	3
No response	6	10	0	0
Course includes				
Lectures only	0	0	1	3
Lecture & Library problems	27	45	10	30
Lecture & library problems & term paper	17	28	10	30
Lecture & library problems & term paper & other	13	22	10	30
Other	1	2	2	6
No response	2	3	0	0
Student response				
Appreciative	16	27	13	39

Table V. Textbooks Used in the Formal Course

Textbook	Institutions Granting Ph.D., Number	Institutions Granting M.A. or M.S., Number
None	11	6
Crane[5]	10	8
Mellon[9]	35	17
Soule[10]	2	0
Other[1,4]	5	3

Table VI. Content of the Formal Course

Publication Covered	Weighted Priority Mean: Institutions Granting Ph.D.	Institutions Granting Masters
Periodicals	1.43	1.44
Monographs	2.64	2.47
Indexes	2.15	1.97
Government reports	4.18	4.13
Patents	4.00	3.99

Table VII. Instruction at Institutions Without Special Courses

Publication Covered	Weighted Priority Mean: Institutions Granting Ph.D.	Institutions Granting Masters
Periodicals	1.44	1.12
Monographs	2.24	2.31
Indexes	1.71	2.19
Government reports	4.05	4.11
Patents	4.60	4.27

INSTITUTIONS WITHOUT A SPECIAL COURSE

Table VII lists the weighted priority means for publications covered at those institutions without a special course in the chemical literature. The weighted priority means for a given item compare favorably with those in Table VI. This seems to support an earlier suggestion that in teaching the use of the chemical literature, chemists differ in the method used, not in their objectives.

A variety of methods are used to introduce chemistry majors to the literature at institutions without a formal course. Chemical literature is taught only incidentally (with the percentage for Ph.D.- and masters-granting institutions, respectively, given in parentheses): By one instructor in connection with some course (8%, 4%); by several instructors in connection with several required courses, such as organic and physical chemistry (61%, 53%); by one instructor in connection with a seminar course (6%, 18%); by one instructor in connection with senior research or independent study courses (13%, 22%); or by other methods (12%, 4%).

Typically, the instruction is accomplished by lectures (19.5%, 3%), by lectures and library problems (32.5%, 61%), by an informal presentation (36%, 27%), or by guest lectures (3%, 0%).

CONCLUSIONS

We agree with many of the responders that there are several essential qualities of an instructional program in the use of chemical literature.

Probably, scope is the most essential quality of an instructional program in chemical literature. As one responder wrote, "One cannot look up something, in something he does not know exists." Also, the art of searching the literature, or the "tricks of the trade," must be an essential as part of the program. One responder suggested that none of the textbooks discusses alternate methods. For example, he wrote,

> A student locates a reference to an article published in 1892. With the date, author and journal the student goes to the library and is told this journal is available only from 1920. The student should be taught that by going to the *Journal*

of the Chemical Society (London)—Abstract Section of that year or the following year and checking the author index, he can locate a very good abstract of the article. The early British abstracts are very thorough and give many details.

It seems doubtful to us that the use of the chemical literature can be taught effectively in an integrated fashion, knowing the human qualities of our faculty members. An effective integration would presuppose formalized cooperation and discussion among several instructors. This is not impossible. We know of a library course involving instructors from four areas of chemistry which was effectively taught at the University of Illinois.

There are strong pressures, we recognize, to require the chemistry major to become well informed in a variety of areas. This is typically done by increasing the number of courses, and something must give. Often this has been the course in chemical literature. Jahoda[6] summarized the situation very effectively:

> Students take on the average of 40 credits of chemistry in their undergraduate work. Of these 40 credits, there should be room for one or two credits to teach them where to find the material they must use throughout their professional careers.

Looking at the status of the teaching of chemical literature 1960–1967, we might find much that is discouraging. First, a sizeable percentage of responding schools have dropped a formal course during 1960–1967. Secondly, a listing of priority ratings suggests that many obviously important topics, such as government documents and patents, are not receiving thorough coverage at many institutions.

There is much that is encouraging. First, there is a strong interest in teaching chemical literature; the response to our questionnaire attests to this. Secondly, although it is true that the percentage of Ph.D.-granting institutions with a formal chemical literature course has decreased,

Colleges and Universities Offering a Course in Chemical Literature:

Ph.D.:

University of Alabama
The American University
Brigham Young University
Brown University
Case Western Reserve University
University of Cincinnati
Clarkson College of Technology
Clemson University
University of Denver
Drexel Institute of Technology
Duke University
Florida State University
University of Florida
The George Washington University
Georgia Institute of Technology
The University of Georgia
University of Houston
Hunter College of the City University of New York
University of Idaho
Illinois Institute of Technology
Indiana University
University of Iowa
University of Kentucky
University of Louisville
University of Maine
University of Miami
Mississippi State University
The University of Mississippi
University of Missouri
Montana State University
University of Nevada
University of New Hampshire
New Mexico State University
State University of New York at Buffalo
North Texas State University
Northeastern University
University of Notre Dame
Ohio State University
Ohio University
Oklahoma State University
The University of Oklahoma
Oregon State University
The Pennsylvania State University
Polytechnic Institute of Brooklyn
Providence College
Purdue University
Rensselaer Polytechnic Institute
St. Louis University
University of South Dakota
Syracuse University
Texas A&M University
Texas Technological College
Vanderbilt University
Villanova University
West Virginia University
Western Michigan University
University of Wyoming

M.S.:

Bowling Green University
Bradley University
Butler University
Colorado State College
DePauw University
University of Dayton
East Tennessee State University
Georgia State College
Holy Cross College
Kansas State College of Pittsburg
Mankato State College
Marshall University
Memphis State University
Moorhead State College
New Mexico Highlands University
Niagara University
Northwestern State College of Louisiana
University of North Carolina at Greensboro
University of Puerto Rico
Rochester Institute of Technology
Roosevelt University
Sacramento State College
St. Bonaventure University
St. Joseph's College
St. Lawrence University
Sam Houston State College
South Dakota School of Mines and Technology
University of Southwestern Louisiana
Stetson University
University of Tulsa
West Chester State College
Western Illinois University
Wilkes College

the percentage decrease is probably low, in view of the pressures faculty members face from a proliferation of courses. Our 1967 survey found 39% and Jahoda's 1952 survey[6] found 53% of Ph.D.-granting institutions had a formal course. Thirdly, a few responders reported new or drastically improved courses in the use of the chemical literature. Related to this is the concern that many expressed. One department head reported he enjoyed teaching a course in chemical literature, and added, "I was not aware of how lax the colleges and universities had become in this part of the training given chemistry students."

To answer our original question: Every chemistry department seems to be teaching chemical literature courses these days, one way or another, some better than others.

ACKNOWLEDGMENT

We acknowledge with gratitude the cooperation of the various responding departments, and the financial assistance of the University of South Florida Foundation.

LITERATURE CITED

(1) "Searching the Chemical Literature," *Adv. Chem. Ser.* **30**, 1961.
(2) ACS, Comm. of Prof. Training, "Directory of Graduate Research," American Chemical Society, Washington, 1963.
(3) Burman, C. R., "How to Find Out in Chemistry," Pergamon, New York, 1965.
(4) "The College Blue Book," Vol. 1, C. E. Burckel, Yonkers-on-Hudson, N. Y., 1965.
(5) Crane, E. V., A. M. Patterson, and E. B. Marr, "A Guide to the Literature of Chemistry," 2nd ed., Wiley, New York, 1957.
(6) Jahoda, G., *J. Chem. Ed.* **30**, 245 (1953).
(7) Mellon, M. G., *J. Chem. Ed.* **38**, 273 (1961).
(8) Mellon, M. G., *et al.*, "The Status of the Teaching of Chemical Literature," (unpublished committee report), 1961.
(9) Mellon, M. G., "Chemical Publications, Their Nature and Use," 4th ed., McGraw-Hill, New York, 1965.
(10) Soule, B. A., "Library Guide for the Chemist," McGraw-Hill, New York, 1938.

An Experimental Course in Information Gathering for Scientists and Engineers*

SAUL HERNER
Herner and Co., 2431 K Street, N. W., Washington, D. C. 20037

Received December 27, 1968

Over a period of six months in 1967, a one-day course to train scientists and engineers in the effective use of the available information tools, resources, and techniques was developed and tested. Testing and evaluation was done by project personnel and by three groups of federally-employed scientists and engineers to whom the course was given. The lecture topics were: Information About Information, Information on Ongoing Research and Development, Current Research and Development Results, Past Research and Development Results, Major American Library and Resource Collections, Organization of Personal Index Files, and Relationship of the Scientist and Engineer to His Information Tools and Mechanisms. In addition to the course syllabus, the project produced a portfolio of demonstration materials and a text entitled "A Guide to Information Tools, Methods, and Resources in Science and Technology." The latter is essentially a recapitulation of the course lectures.

In the fall of 1967, at the request of the Panel on Education and Training of the Committee on Scientific and Technical Information (COSATI), with the financial support of the U. S. Office of Education, Herner and Co. developed and tested what started as a two-day and emerged as a one-day course to train and inform working scientists and engineers in the most direct and efficient means of seeking and acquiring scientific and technical information related to their day-to-day professional activities.

The first and most obvious impetus for the course was the realization that the rate of development of new information tools and resources far exceeds the ability of the average scientist and engineer to understand and use them. Indeed, one need not cogitate exclusively upon *new* tools and resources in establishing the fact that there is a problem; for the most part, the older and more traditional tools and resources have remained within the realm of the librarian and information specialist, and have been rarely or sparsely used by the working scientist and engineer. This leads to a secondary rationale for the course, which was the understanding, or feeling, on the part of the Panel on Education and Training and other participants in the development and testing of the course, that many of the available information tools and services are best used directly, by scientists or engineers themselves, rather than through surrogates, such as librarians and information specialists. The problem was to develop means of ensuring that the scientists and engineers were made aware of the information aids available to them.

The third rationale was a very important one. It has been shown in various studies, at the Massachusetts Institute of Technology, the University of Wisconsin, and

*Presented before the Symposium on Training Chemists in the Use of the Chemical Literature, Division of Chemical Literature, 156th Meeting, ACS, Atlantic City, N. J., Sept. 8–13, 1968.