*Contributed Papers Session*

*Biomedical and Life Science Division*

*Special Libraries Association Annual Conference 1999*

*Getting the Message Across:*

*Constructing an Instructional Program for the Biological Sciences*

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*Introduction*

Development of digital library resources to date has focused largely on technology, software, content, and related matters. There is growing recognition, however, that we, the purveyors of the "new" library, need to be concerned with how our clients learn to use it. Digital collections depend on change and experimentation, characteristics which inherently provoke the need for continual learning. The digital environment also requires users to re-conceptualize what libraries are, how they work and where to find them. So large are the changes triggered by electronics that an extension of earlier library instruction constructs is not adequate. Rather, new programs, built from the ground up, may be required if users are to realize the benefits which the digital environment presents. This paper deals with the construction of such a program for the biological sciences at a large research university.

*Biological Sciences at the University of Michigan*

The University of Michigan is a state-supported research university enrolling 37,000 students, approximately 75% of whom are undergraduates and 25% are students in graduate programs or professional schools. In Fall 1998 the College of Literature, Science and the Arts, the largest unit, enrolled nearly 17,000 students. This included 606 undergraduate biological or biomedical sciences majors (students beyond their first two years of general study) and 113 students working on advanced degrees. An additional 631 students (423 undergrads, 208 graduate students) were enrolled in the School of Natural Resources and the Environment.

The biological sciences in these programs cover a broad range of specialties including cell and molecular biology, ecology and evolution, plant sciences, microbiology, natural resources, environmental management and landscape architecture. In addition, biochemistry is offered via the Chemistry Department, which along with physics, astronomy, mathematics, statistics and geology, is part of LSA. Students and faculty working in these subject areas constitute the core clientele of the Shapiro Science Library. Additional core users come from related interdisciplinary programs.

*The Shapiro Science Library*

One of twenty-three libraries in the University Library system the Shapiro Science Library was formed in 1995 through the merger of four divisional libraries and placed on the top two floors of the Undergraduate Library building. Developed to support advanced inquiry into the basic sciences, the collection numbers over 430,000 volumes and is augmented by more than 2200 periodical subscriptions. The extensive addition of electronic databases and research journals has continued the research nature of the collection. The Science Library is open 21 hours per day most days of the year and has a staff of six librarians, ten support staff, and four FTE student assistants.

*Changing Needs*

The libraries' merger and move to a central building was the most visible factor suggesting extensive instruction would be essential in the Science Library. The combined collections and revamped services meant that even experienced users had to learn new arrangements and relationships, and often new policies and procedures. Sharing a building with the Undergraduate Library also increased undergraduate traffic into the Science Library and many of these users clearly needed guidance. Curriculum changes have also played a role as an increasing number of science courses are including term papers or other library research in their assignments.

Without doubt the most significant factor militating for library instruction has been the unprecedented developments in the digital sphere. Foremost has been emergence of the World Wide Web as a medium of scholarly communication. Proliferation of electronic content, networked systems, and linked servers has enriched the environment but also complicated it. Although some users are able to keep current with developments independently, the sheer volume and frequency of changes have made the task difficult. Observations indicate that many users fall behind. In the absence of some help learning the digital library, a great many users risk becoming information "have nots". It is our continuing belief that the library has a responsibility to reduce this risk insofar as possible.

*Highlighting Instruction*

The reorganization which accompanied the merger of science libraries at Michigan gave opportunity to highlight instruction and encourage its delivery. In the new facility librarians would continue to serve as subject specialists, developing collections, providing reference assistance and giving instruction in information sources pertinent to their fields. They would also be the principal liaisons to the academic departments on these matters. Each librarian in addition would coordinate a functional area of operations. These included on-site services, technical processing, reference, technology and user instruction. Although the first three functions had long pedigrees, technology and user instruction were areas newly recognized as having significant and continuing responsibilities.

As events were to show, efforts to build an instruction program involved challenges, disappointments and some successes. Two periods are distinguishable to date: 1) Summer 1995 - Summer 1997 and 2) Summer 1997 - present. Before discussing each separately it is worth noting overarching features. For example, course-related instruction always reached the greatest number of people regardless of how many stand-alone workshops the library offered or what they covered. Biology and natural resources annually constituted between 65% and 80% of all course-related sessions. (Fig. 1)

| | | | **Course - Related Sessions** | | | | | | | **Workshops** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | biol sci | % | chemistry | % | geology | % | other | % | Total | | **Sessions** |
| Summer 1995 | 0 | | 0 | | 0 | | 0 | | 0 | 4 | 4 |
| Fall 1995 | 5 | | 3 | | 0 | | 0 | | 8 | 10 | 18 |
| Winter 1996 | 12 | | 5 | | 0 | | 1 | | 18 | 3 | 21 |
| Spring 1996 | 0 | | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| **Total** | 17 | 65% | 8 | 31% | 0 | 0% | 1 | 4% | 26 | 13 | 43 |
| | | | | | | | | | | | |
| Summer 1996 | | | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Fall 1996 | 12 | | 0 | | 0 | | 0 | | 12 | 10 | 22 |
| Winter 1997 | 7 | | 4 | | 0 | | 1 | | 12 | 8 | 20 |
| Spring 1997 | 0 | | 0 | | 0 | | 1 | | 0 | 3 | 3 |
| **Total** | 19 | 79% | 4 | 17% | 0 | 0% | 1 | 4% | 24 | 18 | 45 |
| | | | | | | | | | | | |
| Summer 1997 | 0 | | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Fall 1997 | 10 | | 2 | | 0 | | 2 | | 14 | 2 | 16 |
| Winter 1998 | 2 | | 0 | | 0 | | 1 | | 3 | 3 | 6 |
| Spring 1998 | 0 | | 0 | | 0 | | 1 | | 0 | 1 | 2 |
| **Total** | 12 | 67% | 2 | 11% | 0 | 0% | 4 | 22% | 18 | 6 | 24 |
| | | | | | | | | | | | |
| Summer 1998 | 0 | | 0 | | 0 | | 0 | | 0 | 0 | 0 |
| Fall 1998 | 12 | | 4 | | 1 | | 3 | | 20 | 8 | 28 |
| Winter 1999 * | 5 | | 0 | | 1 | | 0 | | 6 | 0 | 6 |
| Spring 1999 | | | | | | | | | | | |
| **Total** | | | | | | | | | | | |

* Preliminary

*Fig. 1*

Instruction in these fields was largely for undergraduate courses while instruction for chemistry leaned toward graduate students. All course-related instruction has been by invitation of the departmental instructor and delivered mostly by librarians and library school interns. Access to desktop computers in campus computing labs has been ample if not always optimal.

*Summer 1995 - Summer 1997*

Initially, though, these features were not apparent. For at least two years the new library was in an experimental mode adjusting to its new quarters, responsibilities and practices. Library instruction was not a unit priority and was not marketed. In general it functioned *ad hoc* and was given in response to individual faculty requests. In the biological sciences these requests were usually for one-hour hands-on training in MIRLYN (the library's computerized information system), MEDLINE, Bio Abstracts and Science Citation Index. Library staff did their best to comply despite the fact that the systems were not interconnected, two sources were CD-ROM-based, and little suitable teaching material was available. The biggest challenge to effective training, however, was the disparity in knowledge and skills the students presented. At one extreme were students with extensive computing experience; at the other were students who had trouble signing-in to the campus network.

Organizational matters within the Science Library also affected instructional outcomes. Vacancies in professional positions meant a doubling and tripling of responsibilities for an extended time. Who should teach and what they should teach needed to be decided. How to incorporate teaching into jobs that were already full was a significant question made more difficult by the need to develop effective instructional materials and keep them current. The notion of coordinating user instruction required definition, clarification and agreement as did the relationship among staff engaged in instruction. There were also questions about what instruction is, what it should accomplish, and what its priority should be.

If such questions were dominant and sometimes confounding they were also essential in establishing a foundation. Many organizational features which ultimately took hold were iterated during this early period. This included policies brought into question and adjusted tentatively though not formally. Instruction for introductory biology courses is a good example. Prior to merger the science libraries focused collections and services on advanced researchers and had little involvement with other users. In the combined Science Library, basic biology courses were among the first and most recurrent requesters for library instruction. Would providing it mean that these students were now to be considered part of the library's core clientele? If so, what would be the effect on other users? other services? other libraries? Rather than waiting for answers, the Science Library proceeded to give the instruction and realized many benefits from the exercise.

*Summer 1997 - present*

*Greater definition to user instruction in the Science Library began to appear in mid-1997 and continues to unfold. Five components have been key: 1) adopting the view that instruction is a program not just an activity; 2) pursuing questions until satisfactory answers appear; 3) developing measurements to determine needs; 4) recognizing that an instructional program may grow larger than anticipated; and 5) increasing the capacity to experiment and implement. These components revealed themselves slowly and often in relation to biology.*

*For two years in their instruction sessions library staff covered the biology databases the faculty requested and were complimented on their work. It was evident students as well as faculty learned things during the sessions. But were they what was needed? Were they the best things to learn in the time spent? From the library's perspective the answers were increasingly doubtful. Skills-based training has its place but for these students such training seemed to be either redundant or overwhelming. A different approach, one featuring concepts and incorporating but de-emphasizing skills, was tried with encouraging results. With some adjustment the approach was extended to other areas and continues to be refined. Principal challenges are to select concepts appropriate to the subject and sophistication of each audience and to keep content current in a digital environment which is in flux.*

*As noted, library instruction encountered students whose knowledge, skills and comfort with computers ranged greatly. The spread was especially apparent in the 100 level biology courses which enrolled first through fourth year students. The differences made teaching difficult. With no expertise common to all students it was hard to know which level to teach to when addressing the class as a whole. Furthermore, indications were mounting that many students were not sufficiently familiar with MIRLYN, the system which holds the library's catalog and important indexes, to access published sources. To better determine actual conditions, a MIRLYN assessment instrument was developed, beta-tested in an advanced botany course and refined after use in the biology writing course. With minor adjustments a shortened version was given to five groups during the 1998-99 academic year.*

*MIRLYN Skills Assessment*

*The mini assessment, which is administered in less than fifteen minutes, consists of seven multiple choice and four open questions about MIRLYN. Some questions concern what MIRLYN is and what its parts are. Other questions test for skills by asking what commands to use in a given situation. ( Fig. 2 ) Still others seek to determine if the student can read search results as they appear on the screen. ( Fig. 3) In an attachment students can furnish demographic information such as university status and how they learned to operate MIRLYN. All testing is confidential and none affects course grades. Responses are scored by library staff and results returned to the course instructor within a week. Data collection on the scores has continued to improve and can now be expressed comparatively across groups including those given a longer version of the test. ( Fig. 4 )*

*Data interpretation is still underway but several conclusions seem evident. Every group tested during 1998-99 had at least a few students with perfect or near-perfect scores, indicating it is possible to know every element assessed. Of the 138 students tested only one did not choose the correct definition of MIRLYN from a broad set of choices. In all*

*groups no less than 80% of the students knew to look in MCAT, the library's catalog, when searching for a book which the library owns. But when three groups were asked where to look for journal articles no more than 65% of the respondents answered correctly. Knowledge about search commands was weaker still. As few as 19% and at most 58% of students in six groups were able to construct two simple searches when asked to do so. The most surprising results, however, concerned the journal article screen where all answers were given in the illustration and the challenge was to recognize them. Of ninety-seven students tested less than a third answered all parts correctly.*

*On a more general level the data suggest that many students know some parts of MIRLYN well, that a small number of students know all the parts tested, and that a sizable group lacks adequate knowledge of the system to use it effectively. These findings have implications for course assignments requiring library research and bring into question the effectiveness of current learning methods. Those which students most commonly use to learn MIRLYN are self-instruction and the help of a friend. The frequency of scores and their distribution across groups reinforce many of the casual observations made previously. The test data, however, are likely to be more persuasive because they were objectively and systematically collected. Nonetheless, at present the data should be viewed as indicative rather than definitive. Although great care was taken in drafting the assessment, the instrument has not yet been reviewed by experts in test design and administration.*

*Identifying Competencies*

*The notion of assessment implies there are competencies students must have if they are to use MIRLYN effectively. Although the pedagogically orthodox approach might have been to identify competencies before creating the test, the fact is that they were articulated afterwards. For each question on the MIRLYN test staff asked: "What is the competency we are trying to measure?" "Is it essential for successful use of the system?" Items identified were then separated into basic and advanced competencies. Recently the basic competencies were quantified in relation to MIRLYN scores to give students a better understanding of their preparedness to use the system. Students scoring above the minimum are projected to use MIRLYN with ease and be free to concentrate on the substance of their work. Students scoring below the minimum are encouraged to take steps promptly to learn MIRLYN basics.*

*Competencies apply to more than just the local system and if they can be articulated for that system it should be possible to identify them more broadly. In attempting to do so the Science Library sought to be inclusive. This meant considering the subjects which are core to the library and recognizing their differing cultures, needs and expectations. It involved addressing the hybrid nature of modern libraries as well as the expanding digital universe in which they operate. It presumed understanding the intellectual processes which operate in the search for information. "User Competencies", (Fig. 5 ) the result of these examinations, is viewed as a working document expressing the constructs which now inform strategic efforts in the Science Library. Also of value is the statement's potential to stimulate discussion, promote community commitment to user instruction, and serve as a platform for articulating competencies for individual subjects.*

*Near-Term Prospects*

*Universities are social organizations and depend on cooperation for success. Collaboration is especially important when enormous change, such as that already underway in libraries, is involved. Making sense of the change, making use of it, and influencing it are foremost responsibilities of user instruction. At the Science Library a major emerging focus is cultivating strategic collaborations within the library system and with faculty in the core departments. Many types of efforts are involved. Among the most critical is continuation of research to determine more precisely what users know and what they need to learn. MIRLYN testing has offered a starting point, confirming some suspicions but also presenting new questions about basic capabilities. Ideally, MIRLYN testing will be extended in the next academic year to cover more courses in more science departments in order to gain a fuller measure of the situation.*

*Efforts are also underway to develop more training materials and more training options. Highly featured are Web-based micro-tutorials which students can access as needed. Ideas such as those outlined in a recent focus group held with undergraduates may be developed as term projects by students in the School of Information. Further focus groups are likely along with campus surveys and intervention interviews as part of the University Library's new assessment initiative. Within the Science Library more directed research is already underway to learn about user instruction offered by selected universities in Michigan's cohort. This subject-specific examination is expected to yield significant information and further shape the local program.*

*The most important and sensitive collaboration without doubt is with the faculty. It is they who are ultimately responsible for the curriculum and for preparing students to an established level of competence. The library can and must play a supporting role in these efforts. In a constantly changing environment support includes identifying problems, creating options to resolve them, and flexing as the situation evolves. Support also includes recognizing commonalities and sharing information. MIRLYN test results, for example, are being shared to alert departments that students may not be as well equipped to do library research as presumed. One assumption, resting on two years of testing, is that the performance levels documented are not unique to specific areas but are distributed across the student body. The broader assumption is that much of what can be learned about user needs and capabilities extends in some degree to all the sciences.*

*Seeing the similarities and relationships across subjects and user groups has been one of the products of a science-wide library instruction program. This is not to say that the goal now is to produce one model for all cases or to ignore the uniqueness of fields. Instead, it is to recognize that preparing a common ground is an essential step toward addressing specialized needs. Sometimes circumstances may preclude achieving the initial goal directly. In effect this is what happened in planning for user instruction in the biological sciences at the Science Library. When the library opened in 1995 staff expected to solidify instruction efforts on behalf of the specialized users, that is, people doing advanced study and research. Instead the library encountered an overwhelming demand to address basic needs first. In working to address those needs we believe we are laying a firm foundation upon which to build a much stronger program, for all the sciences, than we might otherwise have.*

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*I wish to express sincere thanks to Mary Hrovat whose partnership during a critical year helped advanced user instruction efforts significantly.*

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*Fig 2*

*3. MCAT will give you which types of information?*

*titles of books the U of M Library owns*

*citations to journal articles on a subject you're studying*

*the full text of journal articles in a subject*

*titles of books the MSU and Wayne State Libraries own*

. . . . . .

*6. Your next step is to enter your search into the computer. To do so you must use specific commands. There are four main commands you can use to search for Kesey's book.*

*a. What are these four commands?*

*1.*

*2.*

*3.*

*4.*

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*Return to text*

---

*Fig. 3*

*10. You select a database, perform a search, and get many "hits". You decide to look more closely at one of these results. After typing the correct command you get a screen which looks similar to this:*

*Search Request: K=CHROMATIDS Wilson Indexes to Journals*

*(c) 1983 H. W. Wilson C 1 of 63 Entries Found Brief View*

---

*AUTHOR(S): Michaelis, Christine*

*Ciosk, Rafal*

*Nasmyth, Kim*

*TITLE: Cohesins: chromosomal proteins that prevent premature*

*separation of sister chromatids*

*SOURCE: Cell 91:35-45 Oct 3 '97*

*PUBLISHED: 1997*

*DESCRIPTION/PAGINATION:*

*bibl il*

*SUBJECT DESCRIPTORS:*

*Chromosomes--Segregation*

----------+ *Page 1 of 2* ----------

*STArt over HOLdings CHOose <F8> FORward page*

*HELp LONg view <F6> NEXt record*

*OTHer options INDex*

*Held by library--type HOL for holdings information.*

*NEXT COMMAND:*

---

*4-© 1 Public 141.211.228.96 24/16*

***Example 10***

*10. From the screen select and write the following information:*

*a. Number of authors of the article a. _____*

*b. Date of the article b. _____*

*c. Journal in which the article appears c. _____*

*d. Page(s) on which the article appears d. _____*

*e. What to type to learn where to find e. _____*
*the journal in the library*

*f. What to type to see page 2 of this record f. _____*

*g. How many more records you could look at g. _____*
*from this search*

Return to text

*Fig. 4*

| MIRLYN Skills Assessment - SUMMARY RESULTS 1998-1999 | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| **Course** | **GS 151** | **UROP **** | **UROP ***** | **MVS 250** | **GS 148** | **Geog/GS 201** | **Total** |
| **Date** | 9/22/98 | 10/21/98 | 11/3/98 | 1/14/99 | 1/25/99 | 2/5/99 | |
| **Number of students** | 16 | 13 | 12 | 32 | 22 | 43 | 138 |
| **Years at UM (Number of students) *** | | | | | | | |
| Year one | 16 | 5 | 5 | 2 | 18 | 10 | 56 |
| Year two | 0 | 7 | 5 | 17 | 0 | 16 | 45 |
| Year three | 0 | 1 | 1 | 11 | 1 | 9 | 23 |
| Year four | 0 | 0 | 1 | 0 | 1 | 4 | 6 |
| **Maximum score** | 16 | 16 | 16 | 32 | 24 | 26 | |
| **Scoring range** | 8-15 | 8 - 16 | 5 - 16 | 11 - 31 | 9 - 24 | 7 - 25 | |
| | | | | | | | |
| *Numbers in parentheses are the number of students who answered this question 100% correctly.* | | | | | | | |
| **What is Mirlyn?** | 100% (16) | 100% (13) | 100% (12) | 100% (32) | 95% (21) | 100% (43) | |
| **MCAT gives titles of books in the UM Library** | 87% (14) | 77% (10) | 100% (12) | 75% (24) | 45% (10) | 74% (32) | |
| **What is the UGL?** | 87% (14) | 85% (11) | 91% (11) | 84% (27) | 77% (17) | 88% (38) | |
| **Search which part of Mirlyn for books** | 81% (13) | 77% (10) | 91% (11) | 87% (28) | 82% (18) | 70% (30) | |
| **Search which part of Mirlyn for journals** | n/a | n/a | n/a | 65% (21) | 50% (11) | 63% (27) | |
| **4 Commands - a, t, k, s** | 12% (2) | 46% (6) | 50% (6) | 37% (12) | 73% (16) | 39% (17) | |
| **Search statement for 2 of the above commands** | 19% (3) | 46% (6) | 58% (7) | 40% (13) | 41% (9) | 37% (16) | |
| **Which database for science article written since 1992?** | n/a | n/a | n/a | 94% (30) | 59% (13) | 60% (26) | |
| **Which search command best for a new topic?** | n/a | n/a | n/a | 97% (31) | 95% (21) | 84% (36) | |
| **Journal article screen** | | | | | | | |
| 1. Number of authors | n/a | n/a | n/a | n/a | 100% (22) | 95% (41) | |
| 2. Date of article | n/a | n/a | n/a | n/a | 86% (19) | 60% (26) | |
| 3. Journal title | n/a | n/a | n/a | n/a | 59% (13) | 53% (23) | |
| 4. Page(s) where article appears | n/a | n/a | n/a | n/a | 95% (21) | 79% (34) | |
| 5. What to type for holdings information | n/a | n/a | n/a | n/a | 54% (12) | 84% (36) | |
| All 5 parts correct | n/a | n/a | n/a | 56% (18) | 45% (10) | 21% (9) | |
| | | | | | | | |
| * Not all students provided this information | | | | | | | |
| ** 10/21/98 - Biology | | | | | | | |
| *** 11/3/98 - Women in Science | | | | | | | |

*Return to text*

*Fig. 5*

Shapiro Science Library

User Competencies

If they are to be considered fully versed and skilled at remaining current in their chosen fields undergraduate students concentrating in an LSA basic science or SNRE specialization need to be competent in using library and information systems. Students who achieve the foundation competencies will,

• Understand the intrinsic role of information in the scientific research process.

• Know the principal sources of information in their subject.

• Know how and when to choose the principal source(s) most appropriate to specific need.

• Know common search concepts and search strategies.

• Be capable of executing successful searches for information irrespective of the medium (print, digital, visual) used.

• Know the relationships among sources and media and know how, as well as when, to move among them.

• Bring a set of critical skills to the assessment and evaluation of sources.

• Understand the need and propriety for attributing authorship and follow the correct protocols for giving citations.

• Know the principal libraries (digital as well as physical) which support their subject and understand that these libraries are collections of services as well sources.

• Know that the library helps users and is a venue for life-long learning.

Shapiro Science Library User Instruction Group

February 11, 1999

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