As the Cursor Blinks: Electronic Scholarship and Undergraduates in the Library

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ABSTRACT

IN THE ENVIRONMENT OF ELECTRONIC SCHOLARSHIP, the apprentice/journeymen/master tradition is still valuable. As master of the research process, academic librarians must be responsible for training students in research methods. The authors present a model of research that incorporates layers of personal and institutional inquiry the student must work through, layers that help students assimilate new formats and new tasks, expanding or even replacing established habits of critical thinking. By using the accumulated practitioner lore of library instruction and educational psychology, librarians can effectively redesign student work and reconfirm the unique role of the library.

INTRODUCTION

It has been a quiet spring. According to Terborgh in the May 1992 *Scientific American*, radar monitoring shows that 50 percent of the songbirds migrating north from the rain forest have disappeared since the 1960s. Costa Rica in the 1950s was 75 percent rain forest, but only 25 percent rain forest in 1990. Along the Maine section of the Appalachian Trail, the second-growth forest is being clear-cut, and all over the world amphibians are disappearing.

With the world in crisis, how can people be expected to use the library? The needs are so great, the calls to action so many and so urgent, how can one spend time in study? Librarians, in consternation, are realizing that these questions are no longer rhetorical, even on college

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campuses, because of the promise of "electronic scholarship," the promise that each person will be able to use the computer to wander lonely as a cloud through fields of accurate and appropriate information. Then, armed with data, one would be able to take swift action on life's issues. Librarians and faculty, however, are aware of the gap between promise and reality. Recognizing valid facts is not that simple; framing right action is downright difficult. Throwing water on a gasoline fire makes it spread; throwing large-scale development projects at third-world countries has not been such a good idea either.

Reasonable people can disagree on issues such as abortion or affirmative action; a grandmother's adage, "in polite company, avoid discussing race, religion, or politics," remains useful. The value system of the college, however, encourages discussion, encourages the search for solutions, and presents study as an active process, essential for any interaction with crisis. Facts, such as the litany of environmental impact figures above, mean nothing without personal inquiry and reflection; the well-prepared mind can, even in crisis, take right action.

Validation of study and of college education no longer automatically validates the college library; the value of the library to faculty and students is no longer a given. Academic librarians have been surprised by this. Just as, to a man with a hammer, every problem looks like a nail, to an academic librarian, the college library seems the source of solutions: do enough research, amass enough information, study it closely, and the truth shall set you free. The issue is greater than a question of whether the technology works (Crawford & Gorman, 1995). Add enough technology to the library, the librarians say, create the environment that nurtures electronic scholarship, and the role of the library is assured. The question really is, as it has always been, How does the mind work? And, then, How do librarians participate in preparing student minds? The validation of the academic library lies in the way the profession answers this last question.

The preparation of the student mind has been based on the academic premise that knowledge is cumulative, that both content and rigorous method can be taught, and that participants should retire from the world to do this. Our society identifies college and university faculty as experts, the intelligentsia, with a professional responsibility for not only knowing what is going on but also for determining right action (Havel, 1995; Richardson, 1995). Most colleges in the late twentieth century, in order to position their "experts" for influence in the world, have adopted the mantra:

> Change is Good.
> Change is Inevitable.
> Rush to keep up so that you can be a
> change maker, a leader.

The conflict for the faculty between the pressure to develop new knowledge and technologies and the need to reflect on the right course of action permeates every course. Faculty who recognize this tension are committed to teaching students to learn and then to act, to be part of a civil society where citizens interact to understand and move on common problems. For undergraduates who want to think clearly about the world, who want to participate effectively, training in the skills of locating and evaluating information is essential. The new environment of electronic scholarship is affecting the college, the civil process, and even social relationships.

The electronic dissemination of information is changing our culture, changing our definitions of what culture is. The word "culture" once referred primarily to nurturing activities, as in "agriculture," and was then extended to refer to the intellectual and artistic concerns of civilized (read "urban") and sophisticated people, people whose taste and activities were to be observed and emulated. As American museums, orchestras, and libraries were established and citizens were urged to become cultured, sociologists shifted the word to encompass socially transmitted behavior, as in "street-corner culture" and "corporate culture" (witness the rise of McDonald's as a place that both establishes American culture and provides a training ground for children to practice public social skills). Librarians who thought they were part of the (civic) culture's process for recording and using (intellectual) culture must now find a new place in the rapidly changing social patterns. A popular culture deeply in love with technology is replacing now quaint enlightenment notions of the "good person" (Lasch, 1991). Public ethics are replaced by efficacy; for example, note the debates at the recent UN Climate Control Conference, the Cairo World Population Conference, and the Rio Conference, where what needs to be done was replaced by what is politically acceptable. The fact that this tension between right and might is age-old does not diminish the reality of the dangers posed by the power of new technologies (Eco, 1995).

In the United States, citizens are exposed to a mind-smothering dust storm of sales messages, billboards, slogans, reminders, and sound bytes of news, estimated for New Yorkers, for instance, at 3,000 to a million per day (Nare, 1995). Undergraduates, having grown up with television and shopping malls, are inured to these messages whose sheer volume and lack of substance ("Just Do It," "Hi," "The Stuff Legends are Made Of") create a grainy daily backdrop of static and flash (Stoehr, 1994). In a similar way, as a part of this information culture, librarians, too, are inundated by messages promoting the consumer imperative, urging them to transfer scarce capital from collections to computers, to connections, to delivery on demand (Honan, 1994). Information becomes a product as subject to fashion and change as automobiles. Automated systems with a

three- to five-year shelf life result in search and presentation skills with a three- to five-year shelf life. The obsolescence of information held past its sell-by date, whether technical standards or literary theories, is promoted as the forgivable reality that accompanies any commodity. According to the consumer imperative as applied to information, one never has enough information, new enough information, enough time, enough genius, or enough state-of-the-art equipment to do the job. Whatever issue one investigates, it will never hold still or hold shape long enough for one to grasp its content and implications. Historians of the twentieth century commonly complain that, in American history since the Vietnam War, so many documents have been created on any major topic–the Gulf War or welfare, for instance—that no one will ever really know what happened. No wonder students protectively adopt the thick skin of boredom, or that librarians are alternately swept up in the excitement of developing new resources and exhausted by the automation hyperbole as fax and Internet become yet more sources of junk mail.

Apprentice-Journeyman-Master

> No thing great is created suddenly, any more than a bunch of grapes or a fig. If you tell me that you desire a fig, I answer you that there must be time. Let it first blossom, then bear fruit, then ripen. (Epictetus in *Discourses*, Book 1, Chapter 2)

It is librarians, as information specialists, who understand that information—biologically, cognitively, and culturally—is much more than a commodity. We must articulate and defend this perception and teach both faculty and students the difference between information consumption and reflective scholarship. Scholars as well as students need to develop adequate filters for the data glut; librarians have the tools to teach others such critical skills. In the film *Black Robe*, which tells the story of the first Jesuit priests in sixteenth-century Canada, a priest is lost in the woods. The Hurons, finding him, ask: "Why didn't you look at the trees?" Librarians, watching the forest of information (or is it Kudzu vines?) sprouting all about them, must teach faculty and students how to map and evaluate the terrain.

Like lawyers and physicians, librarians are public professionals. We all work with individuals—clients, patients, or patrons—to address their unique needs and improve their condition. That, in itself, is a public good but, in addition, the experience gained from each intervention becomes part of the public professional knowledge base, part of the common wealth both practitioners and individuals may draw upon. This knowledge, amassed and organized and made available as theory and practice, is a public good. The process of learning to use this common wealth is well represented by the apprentice-journeyman-master craft tradition, a

tradition combining content, skill, and attitude that, especially in academe, persists in our mechanized and electronic culture. As Giedion (1948) observed in *Mechanization Takes Command*, the need for organized living within the community has been filled in part by the social obligation of each citizen/participant to pass through these traditional stages of training (p. 39). From apprentice to journeyman to (perhaps) master, the process yields eminently qualified workers. The Progressives of the early twentieth century saw that this process and wealth of professional information could be made available as well to citizens who need to make informed decisions. That is, there is an apprentice-journeyman-leader process in civic life.

Whether college students are profession-oriented (accounting, engineering) or liberal arts students, their involvement in library research and learning the knowledge structure of their subjects is an apprenticeship. Here, electronic scholarship is more than a new tool for the creation and accumulation of public knowledge. The information technologies create opportunities we are forced to accept in our geographic, government, and scholarly communities (Allen, 1978; White, 1994; Winner, 1992). Students, as apprentices, learn how to listen in on shop talk, collaborate across continents, and contribute to databases. Their relationship to both faculty and subject matter may indeed be less passive but remains a tutorial relationship simply because only a subject master can deal with such great amounts of raw data.

The apprenticeship of the undergraduate student is spent with the master—i.e., the faculty member who is expert in the subject matter. The librarian, however, is expert in the research process and can rightfully assume responsibility for that area. The importance of this process was vividly brought home to one of the authors whose one-credit research course had been required for mortuary science students. Years later, one graduate stopped the librarian on the street and commented that her research course was the only course that had prepared him to deal with matters as diverse as AIDS, the EPA, and zoning boards. All of these had changed dramatically since he had graduated but were carefully documented in resources he could find at the library.

In the apprentice-journeyman-master culture, students at every level need opportunities to apply concepts learned in class; they need to practice with the materials and methods of the discipline. Because accrediting agencies understand this, college curricula are full of practicums, co-op study programs, laboratories, portfolios, and class presentations. The very crush of information available gives librarians new opportunities to work with faculty to build research assignments into every course, assignments not necessarily expressed as "5-7 pages on any topic." The traditional term paper is only part of the mix, merely one format for demonstrating a student's skills and not well-loved by students or faculty. New

free-ranging assignments encourage contact with scholars and leaders in the field, allowing for the serendipity of the search and the exploration of personal enthusiasms. They guide students to the information sources of real-world decision-making (statistics, slogans, polls, etc.) and set standards for scholarship and presentation. Most significantly, these assignments deliberately give students opportunities to practice using standards of critical thinking and source evaluation in applications that matter. These assignments, examples of which are included at the end of this article, require the use of primary documents, professional journals, and electronic sources, as well as imagination, reflection, and other creative processes.

Information and Knowledge

The information environment has become so vast that information as a substance becomes analogous to water, air, space (Smiley, 1995, p. 137). Whatever one needs is easily available; it does not seem to matter what one puts into the volume (sewage, smoke, trash), and one pays little daily attention to its nurture. To use one of the current academic metaphors, our students are in a gathering rather than a hunting mode when it comes to information (Quinn, 1992). Like wind and waves, the information keeps flowing by. One can let experts deal with the stew of data; one can leave scholars to sift the sands of trivia. The coarse, the foolish, the unreliable, the malevolent, the beautiful, and the useful are all mixed up together in conversation, on the Internet, in magazines, on television. The myth is that Gresham's Law (bad money drives out good) does not apply to information. The assumption is that current information is wanted (Wilson, 1993), so that old information becomes as polluting as wrong information. Experienced librarians know that this is not the case; people will eventually settle for what is there even if it is not precise or up to date. As for locating information, the folklore of online and Internet searching suggests that any search word will do; that one no longer needs structured thinking, taxonomies, charts, chains of logical implications, or grouped sequences, a list of sources, or even an experienced guide. The parallel myth is that without the ubiquitous indexer's interference, one can freely connect to the world of data.

If information is so abundantly and cheaply available, what then is the value of research expertise? Students are unsure whether research (or life) is a process of getting the one right answer someone else may already know or a process of settling for a good enough answer. Learning the balance between the two has always been an essential part of any apprenticeship. Yet the mental processes turn out to be as important as the content and eventually lead to the journeyman's confidence in a third possibility: there are always new answers to be created, and research (and life) can add to the common good (Drucker, 1992). That exhilarating

confidence in the power of well-chosen information properly applied comes only with practice. For instance, in an analysis of fighting in the National Hockey League, Lapointe (1995) indicates that thinking teams who relied on strategy and skill but ranked last in fighting won the Stanley Cup in 1991, 1992, and 1994.

In the past, as information formats and intellectual work changed dramatically, much anxiety surfaced. Socrates bemoaned the move from oral to written culture because the thinker no longer needed to be present; one could read the manuscript at any time. The arts of debate, rhetoric, and discourse would not be exercised; one could not argue with an author who was not present (the word "author" comes from the Latin "to create" but is used for the creation of the written word, conveying the impact of writing on credibility, that is authority). The rapid supplanting of script by the printing press provoked similar critiques on what would be lost: Trithemius (1462-1516) in *De Laude Scriptorum (In Praise of Scribes)* held that the art of writing and the care of conveyance of thought would suffer. As our culture now passes into a digital communication era, Birkerts (1994) sees "deep reading" as a necessary loss in the electronic age. Purves (1990) explores the parallel cultures co-existing today in his depiction of a scribal society in an information age: the issues of accuracy, definitiveness of text, and prevalence of information over knowledge are explored. Norman (1993), in contrast with those who anticipate the loss of significant skills, attitudes, and social conditions (Brod, 1984; Chomsky, 1989; Schmookler, 1986; Winner, 1992), sees the anxiety as focused on the necessary human values it is indeed possible to maintain by rigorously treating the computers as tools—"things that make us smart." Twenty years ago, mediated (audiovisual) instruction was touted with much the same language that advance men use today for telecommunications. Paralleling that, educators, psychologists, and librarians have argued quite convincingly that our students no longer know how to think, how to process information logically, or how to verbalize and organize inchoate thoughts; as a result, they do not know how to learn (Resnick, 1987).

Unfortunately, the library profession seems more concerned with the manipulation of data than with knowledge. Library schools are changing their names and curricula to reflect these new trends in the information business. While many are now Schools of Information Science, not one is a School of Knowledge or Wisdom. While the library school curriculum requires online skills that quickly become obsolete, it does not require, for instance, cultural anthropology as a prerequisite for collection development. Postman (1992), in his book *Technopoly*, describes our culture of technology as promoted by a market economy. We are confronted with new approaches to knowledge as well as challenging assumptions about what knowledge is; what value knowledge has; and how it can best be transmitted, recorded, and applied. The

technology-driven culture currently celebrated (Negroponte, 1995), as well as gloomily depicted (Birkerts, 1994), and reluctantly rethought (Drucker, 1993; Stoll, 1995) presents librarians and the profession with rapidly changing options for participation, leadership, or marginalization (Price, 1991). Whatever role college librarians choose to play, they must involve college students in the debates surrounding electronic scholarship (Bruner, 1986). Students must be prepared to become bridges between the old and new cultures, not as antiquarians, perhaps not as visionaries, but as people committed to saving and having the best of both worlds.

Electronic Scholarship

New situations have hidden possibilities, often not seen until an innovation is diffused and widely adopted (Rogers, 1983). With writing, disputation and analysis can continue long after an author is dead. Once the existing script books had all been printed, there was demand and opportunity to write new ones, including novels and newspapers. As with the current electronic scholarship revolution, with each information innovation, intellectual productivity increased (Drucker, 1993). The expert/scholar residues left in publications or on the Internet are like tea leaves one can use in any age to predict the future. The diffusion of communication across the Internet has led to World Wide Web (WWW) publications from unexpectedly diverse authors: from fifth graders (GrandRiver Elementary School: http://web.cal.msu.edu/JRSI/GR/BradClass) to refereed electronic journals (*Psycoloquy*, for example). These resource allocations of both capital and effort to electronic scholarship can affect which theoretical problems are studied, which methodologies are used, and how the research comes out. The traditional linear model of education has great power and, used in conjunction with the Internet, great connectivity as scholars are able to focus on narrow interests and browse across disciplines. Because one cannot always know how information will be useful, students should be encouraged to rummage, something that is well suited to computers. However, in libraries, the "just-in-case" model of collection development has given way to the "just-in-time" model, which assumes that when we need the information, it will be available. This is akin to the hubris of assuming that a cure for cancer will arise from spending enough time and money and scheduling the discovery.

This vision of the shifting of work from page to screen may seem Panglossian when one considers the array of skills needed to use the technologies and the resulting time-consuming learning curve. To take advantage of what automation offers, the student must learn multiple computer literacies in order to:

- generate classes of data to be examined;

- extend the search vocabulary;
- use a search profile to do the searching;
- sort through the masses of data to determine what is/is *not* relevant information;
- save the search histories;
- compile citations without laborious typing or writing; and
- record the information trails (McClure, 1994) .

All of the above options for changing the way a student works with automation are new in this decade, although they are extensions of previously existing recommended search methods. Students have universally adopted and extended new ways of sorting through data by applying other technologies, hard and soft. Undergraduates no longer "take notes"; they use markers to "highlight" photocopied documents. Time spent gathering data is compressed when students download abstracts or save files to a directory. Time required to present information is compressed through word processing used to create new textual relations, to experiment with sequence, style, and impact of format. Yet human information processing cannot be similarly compressed.

The innovations involved in electronic scholarship present expansive opportunities and severe limitations, although the limitations are not visible in OCLC's recently posted definitions in their WWW advertisement for its services (see Figure 1).

New Electronic Scholarship

1. the application of the digital electronic computer and telecomunications networking to study, instruction, research, and experience: Scholarship
2. to use electronic means to find specific information from a large body of information: Research
3. a student's work or activity done on a computer or computer network: Homework
4. the process by which an author prepares a work for publication: Writing
5. the digital version of a printed book or serial: Electronic Journal
6. organizing, storing, and providing access to information and knowledge in electronic form: Electronic Library
7. electronic communication over the Internet and World Wide Web (WWW): Information Superhighway
8. a way of life, syn. see Scholarship

Figure 1. New electronic scholarship

Electronic scholarship, as outlined in figure 1, refers to methods of work which have developed over a period of time; the seamless integration of different components of scholarly work is what is promised in the rhetoric.

The language used in the advertisement mirrors our assumptions about what the undergraduate now faces. The belief that all is digitized and available—and instantly so—is incompatible with conditions in which undergraduates are truly educated, that is, "led into" one's own inquiry (Carr, 1988). Although finding relevant information is likely to be speeded up by automation, the necessary conditions of reflection, making sense, and building mental constructs take time. Guthrie and Dreher (1990) measured several salient factors in information searching: category selection, extraction efficiency, integration, and quality of sequence. These factors involved students' repeated examination of information as they constructed an essay. Cooper's (1985) framework for integrative research reviews focuses on a chronological sequence in which literature review is conceptualized as a primary scientific process. Iterative cycles are not a prominent part of this framework. In contrast, Cavaliere's (1991, 1992) analysis of the Wright brothers' methods supports the idea that information construction is a cyclical process maintained by episodic patterns. Her learning behavior framework provides for both the chronological and cyclical nature of individual inquiry. The visualization of the connected patterns of people, events, ideas, and opportunities that were interwoven in the Wright brothers' airplane (Cavaliere, 1991) captures the loops, dead-ends, unexpected links, and downright leaps of faith that are integral to human research.

Giving undergraduates the opportunities to experience cyclical and episodic patterns is difficult in many presently existing learning environments due to constraints on time for the task and on attention available from mentors. The computer has been seen as surrogate mentor, compressor of task time, and a tool for the construction of ideas (Lajoie & Derry, 1993). Prior to the automation of the major library tools, scholars spent more time on tedious labor than conceptual work. The nature of thought involved in tracing citations, recording them, going to other libraries and collections, locating relevant materials, typing drafts, etc., would be at the lower end of Bloom's Taxonomy. The computer is essentially a sorting machine, capable of speeding up such work and theoretically freeing up valuable thinking time for the student to use higher-order thinking skills (analysis, synthesis, and evaluation) in the pursuit of individual inquiry (Anderson & Sosniak, 1994).

Commonly, problem-solving as taught in college courses is actually knowledge transfer. Faculty ask a question or pose a problem which has a right answer, a known answer toward which the students work in laboratory experiments or essays. This directed search demonstrates concepts

rather as a concert demonstrates music, but it is not the same thing as real-world manipulation of concepts learned in class (Sawrey, 1990). The apprentice has not become the journeyman. To complicate this, the goals of everyday life are not the same as the goals of science (Reif, 1991), of social sciences and humanities (Bruner, 1986), or of the professions (Resnick, 1987). College students need to learn how to make inferences within the parameters of the discipline; how that information is constructed, validated, and organized (Lewontin, 1995); and how to think about thinking (metacognition) as a method for understanding nonlinear thought (Dijkstra, 1991; Greene, 1995; Martin, 1981). As one student said: "Life ain't as if"; if students do not master these higher-order thinking skills, they will always be at the mercy of intellectuals or swindlers with the all-embracing "right answer" (Havel, 1995).

Martin (1981) comments in her article, "A Garbage Can Model of the Psychological Research Process," that it would be useful for students to comprehend a research model that accurately describes the gap between the rational model seen in their texts and the anarchic model subject to dead-ends, serendipity, and hunches that more often prevails (for examples, see McDonald, 1995; Wallerstein & Blakeslee, 1989). The myth that results are an end-point rather than a beginning point or a never-reached point could be more easily dispelled as well as could the myth that a once-read text has nothing more to offer.

Undergraduates in the Library

Today's undergraduates face often staggering tuition costs in a college environment in which an increasingly diverse student body is being educated with decreasing resources ever more thinly spread. One of these that stands out primarily because of its absence is the personal encounter with the faculty (Richardson, 1995). In a study done by the Higher Education Research Institute, fewer than 50 percent of the undergraduates at public research universities were satisfied with their contact with professors and administrators. Private research universities fared better; 64.2 percent of students surveyed reported satisfaction. Private four-year colleges, however, had a 75.4 percent contact satisfaction report. Some institutions, such as Syracuse University, have even found it necessary to restate their commitment to a student-centered, rather than a research-centered, environment. It is highly likely that, unless at a college where faculty put a priority on teaching over research, an undergraduate faces large classes, perhaps taught by graduate students, and has little if any opportunity for individual discussion and debate with scholars.

To make matters worse, the above-noted increasing diversity includes disturbing variables in students' readiness for college-level work. Recent national testing of high school seniors' reading proficiency indicated that only one-third of high school seniors are proficient readers ("Decline

Found in Reading Proficiency of High School Seniors," 1995, A18). The items for testing included: two texts about the Battle of Shiloh (a journal entry by a Union officer and an encyclopedia article), the 1040 Federal Income Tax short form, and an article on sperm whales. "Advanced readers" (4 percent of the total) were those who could describe abstract themes and analyze meaning and form. "Proficient readers" (30 percent of the total) were able to draw conclusions from essays and analyze literary devices. "Basic readers" were defined by their capacities to understand the text and make interpretations. The undergraduate in the 66 percentile who can merely read on a basic level will surely have trouble with information functionality.

Undergraduates encounter librarians primarily in person in the face-to-face reference situation where the librarian is expected to address these issues of infrequent faculty contact and weak academic skills. It is the librarians who may take over as coaches and guides through the thorny process of creating a researched report. It is the librarians who must infer a great deal about the student's ability from evidence such as body language, blank monitor screens, and huge piles of paper, while the student faces confusion that goes far beyond correct button pushing or logical search strategies. Undergraduates often have difficulty assessing resources for accuracy. They may be warned by caveat emptors accompanying the publisher's statement or by librarian-created on-screen warnings such as those taken from a large university's terminal display (see Figure 2).

Figure 2. Typical example of on-screen warning

In "real life," the rules for locating and using information are becoming ever more elaborate, requiring even ordinary mortals to carry increasing mental baggage. For the student, the complexity of the library is just one more cognitive burden, involving barely understood choices—which library, which format, which terms, which sources—while estimating and re-estimating the time, costs, and value of the results. For students using a variety of online databases, it is as though they were parking lot attendants, where every vehicle is not only a different make and model but has a different configuration—e.g., the three pedals on the floor change function with each car. The procedures for using the databases are so complex that there are whole volumes of documentation at the BRS, ERIC, or OCLC terminals dedicated to helping users search. Meanwhile, at the old familiar *Readers' Guide* and *New York Times Index*, instructions require one page; those for the international telephone system take only fifty pages of the telephone book.

Kuhlman (1994) discusses psychological disequilibrium as a necessary aspect of development in the assimilation of new structures of thinking. Two considerations that are commonly part of a learner's disequilibrium in an instant-data universe are the loss of the practice of reflection and the loss of skill in evaluating evidence. Without in-depth involvement and faculty insistence, students may rely even more on packaged reviews, abstracts, and what is available, further short-changing themselves of the real work of scholarship. The combined authority of the computer and the printed word seems to students unassailable; they hurry on, accepting the predigested information because, as automation transforms the culture into its own image, the whole world seems to be in a hurry. Librarians need to be aware that values are being communicated. The computer can be used to personalize access to information, thereby enhancing the student's own reality, or it may become part of the disembodiment of intellect that also occurs on the Internet.

Layers of Learning

Despite librarians' improved teaching expertise in developing motivation; dealing with diverse student needs; and creating materials, assessments, and delivery methods, the purpose of instruction, until recently, has remained the same: teaching students to navigate a "library layer" (bibliographic skills) to reach a "scholarly layer." Since the 1980s, this library layer has been supported by a "technology layer" (electronic applications for searching, accessing, and evaluating information). These technologies extend the environment for learning beyond classroom, laboratory, and library and beyond the limits of time frames (Fox et al., 1995). Today's undergraduates need, unlike earlier generations, specific competencies in all four layers of learning (inquiry, library, technology, scholarly) in order to become truly literate (see Figure 3)

INQUIRY LAYER: the student

Can recognize the need for information
Can conceptualize questions
Has the ability to extend questions into language
Has the ability to individualize an inquiry and direct it appropriately
Has the inclination to re-articulate inquiry in the light of information

LIBRARY LAYER: the student

Has the ability to describe own information need
Recognizes and applies the classification of information used in the information environment, whether it be a physical setting or a database
Recognizes format distinctions
Has knowledge of and can apply location descriptions
Can navigate the environment from citation to access

TECHNOLOGY LAYER: the student

Can translate own question into search structure
Has awareness of and can apply accurately search protocol for particular database
Has multiple computer literacies
Can decode electronic text
Can operate computer and peripherals

SCHOLARLY LAYER: the student

Can recognize data and transform it into information
Can have a "dialogue" with a represented point of view (whether in print or in person)
Has demonstrated skill in communicating discoveries, findings, to identified audience
Can reflect on diverse points of view, holding onto ambiguity and tension while examining evidence
Has skill in developing an individual viewpoint, relationship with the literature
Has skill in examining individual pieces of literature and developing a pattern of inquiry across all literature examined on a topic
Has developed metacognitive strategies to regulate learning, searching, and production of information.

Figure 3. Layers of learning in research in an electronic enviornment: Undergraduate competencies

The addition of the technology layer to skills required for searching has narrowed the focus of library instruction almost exclusively to the use of technology. While the recent library instruction literature has focused

on the library layer and the technology layer, the undergraduate actually needs more focus on the inquiry layer and the scholarly layer. These two layers form the most permanent competencies and those that best teach and require levels of formal reasoning. The two "sandwich" layers (library and technology) will likely become more transparent over time because of rapid improvements in the design of search and access technology (Marchionini & Maurer, 1995). It is the librarians' task to push the students further along the Piagetian cognitive spiral. Many researchers have articulated these four competencies to different constituencies, usually in isolation from each other but with similar language (Clandinin & Connelly, 1992; Lajoie & Derry, 1993; Mann, 1993; McClure, 1994; American Association of School Librarians and Association of Educational Communication and Technology, 1988; ACRL, 1992).

What separates or integrates these layers of learning depends on the faculty, the librarians, and the students. Ideally, all four components are deliberately combined, even specified, in the independent research assignments so that the "need to know" is established for all and becomes a joint venture. The librarian as class instructor explains the library and technology layers as they support the scholarly layer. The undergraduate, in response, is expected to develop the inquiry layer. The resulting synergy in instruction is based on both librarian and faculty expertise. What is new for all is the constantly changing technology layer and its benefits; these threaten to absorb energy and overshadow the more critical layers. This persistent reformulating drives new everyday, temporary decisions on what students need to know: how much, in what sequence, with what materials, to what goals. Institutions should continue their education reform efforts by implementing an integration of the layers of learning needed for scholars to function in an electronic environment (Martin, 1993; Scheingold, 1991).

Librarians are increasingly challenged to maintain the learner-centered tradition of the library and still convey the exacting standards of the inquiry and scholarly layers so that students can make the best use of electronic scholarship. Specifically, in the electronic environment, librarians should act to preserve the research behaviors that apply regardless of information format, promoting those traditions of the best scholarship that help the student-apprentice understand just what is "good enough." Librarians can contribute to the undergraduate experience by creating opportunities for:

- individual inquiry;
- development of new perceptual and motor skills;
- episodic and cyclic learning, including time for reflection;
- evaluation of collected information;
- recognition of feelings as part of the process;
- collaboration with faculty and students.

Individual Inquiry

Every regional academic accrediting association includes in its standards some variation of the requirement that, for a course to be considered college level, it must require students to demonstrate independent use of concepts taught in class. The individual inquiry pattern a student develops in the process of completing a well-designed assignment can often be learned through the library.

Development of New Skills

The librarian's eye has been trained, almost subliminally, to respond to electronic text (Costanzo, 1988; Kerr, 1990). Reading electronic text on a computer monitor involves knowing that the text will "go away." Reading display screens involves recognition of nonstandard sequence: the "hot spots" or instructions do not necessarily read from left to right, top to bottom. Further, the electronic texts in databases may differ significantly from each other. These features are routinely anticipated by the experienced librarian familiar with many databases. Librarians' "information filters" are built as patterns, perhaps by deliberation, perhaps by repetition. The motor skills needed to use databases have also been built by practice into habitual patterns: manipulating electronic text; clicking on WWW sites; anticipating the location of instructions; and moving one's eyes to the bottom, side, or top of a screen. Recognizing what transformation each librarian has personally gone through in the process of learning to use the technology is a value in itself and a basis for designing learning activities.

Episodic and Cyclic Learning

Good research is seldom completed in one setting nor can it be taught or mastered in one class. Students often need to learn that the research process involves many cycles of collecting, evaluating, and applying information. Librarians need to encourage students to return to the reference desk as their work proceeds so that the project can blossom in ways the students might not foresee. Just as the student needs time to reflect on the process and the gathered information, the librarian needs time to reflect on the student and the developing project, bringing to the interaction an appreciation for what the student is learning and for how the research "works." Some recent practical examples of what librarians need to know about students include: understanding with fresh eyes what learners really see on the screen (Kerr, 1990; Kulthau, 1991; Weiss, 1994); knowing how one learns to use a system (Weiss, 1994); recognizing that research of any substance is a struggle (Kuhlman, 1994); and assessing the impact of new formats on search patterns and the determination of the validity of information (Campbell, 1989; Manes, 1995).

Evaluation of Information

Evaluation is essential in inquiry and scholarship, but to the extent that skill in assessing the reliability of any source is a function of age and experience, undergraduates are unprepared to appreciate the importance of evaluation. They have picked up from the culture a large semi-faith in the printed word and much faith in the online report. Students have accused our libraries of "hiding the truth" from them when there was virtually no documentation of what right-wing radio calls the New World Order. "If Robert McNamara can now admit he was wrong about the Vietnam War, then, by analogy," the student says, "there is a plot to keep this information from us." Finding the information they want on the Internet, they are often unwilling to subject it to the canons of scholarship.

The challenge of instructional use of the packaged information product is described by Manes (1995) in his review of an art compact disc:

> Since text is not searchable, there is no way to know, say, that a mysterious passing reference to the Nabis group is clarified in great detail in Bonnard's biography. An initially impressive time line ends up seemingly awkward, with snippets of political history here, literary history there. No catalogue raisonne has been developed for the Barnes collection, but here there is not even an overview of its holdings. But all these quibbles vanish as you fall under the spell of the glorious images. (p. C8)

Not necessarily. Librarians tend not to fall under the spell of images as they contemplate information products, since undergraduates may not know the difference between errors of commission and omission of information.

Students skilled in in-depth reading will be concerned with authentication of sources, including disembodied fragments, miscopied/edited texts, omissions, and all the sins electronic texts are heir to. The deep reading of text should transfer to deeper reading of objects and actions so that students see extended meanings in ordinary things (why would anyone patch a cook pot? a dishtowel? a sock?) and the extent to which information is understood to be embedded in these things. As DNA and RNA are embedded in cells, so are the manufacturing processes embedded in the refrigerator and the political processes in the drinking water at the faucet.

Recognition of Feelings

Computers may not have feelings but people do and, because information and automation have been so appropriated by the preachers of progress, people new to research and new to computers face emotions ranging from exhilaration to fear and resentment. Most librarians have likely faced similar anxieties when confronted with new technologies, usually on the job, with little time to master these skills in the context of

personal inquiry. Current research on the most effective ways computers can emulate human tutors suggests that the expert human tutor does not follow instructional design processes; the tutor attends predominantly to affective states of the student (Lepper et al., 1993). The affective component is seen as driving information-seeking behavior by psychologists interested in the whole research process (Kulthau, 1991). With electronic resources, the variety of undergraduates that encounter computers can range from the eighteen-year-old who grew up with Nintendo and computers in the classroom (Sendov & Stanchev, 1986) to the middle-aged student, now very motivated but with minimal computer experience. The librarian/instructor cannot afford to assume that a learner will know how to read that screen or operate the system (Teaching and Technology, 1991), nor can the librarian assume that a systematic method of reviewing literature has been part of a student's past experience. It has been said of Leonard Bernstein that he was a great teacher because he did not assume you knew what a fugue was nor did you feel inferior because you did not know. Students particularly need help dealing with feelings about time: how much time research really takes, how much time to spend searching any one source using any one strategy before giving up, how long to wait for an interlibrary loan or a blinking cursor.

Collaboration with Others

Librarians need to recognize that they have the power to create opportunities for students, faculty, and themselves to work together within the research process. Students can be encouraged by well-designed assignments to collaborate with each other, seek out faculty members, and reflect on the larger-world ramifications of their studies. Faculty cannot only be wooed by librarians promoting new resources but can also be involved in the design of library-intensive projects. Indeed, without faculty participation, students will seldom use the library.

Assignment Design

Both classroom faculty and librarians agree that undergraduates need learning experiences from which solutions and patterns can be generalized across disciplines for lifelong application (American Library Association, 1989; Breivik & Gee, 1989). The educated person will be one who generates new patterns of inquiry, applications, and networks in new situations (Drucker, 1993). Novak and Gowin (1984) describe the kinds of knowledge that will be essential for lifelong learning in their book *Learning How to Learn.* The very title of the book could be seen as the essential purpose of all library instruction. "Learning bow to learn," however has, for many librarians faced with severe time constraints and many undergraduate classes, crystallized into a curriculum that could be described as "cracking the code." If one-shot information-dense classes

can be replaced by learning environments in which an undergraduate has the time to learn, the librarian's extensive experience with all layers of the research process may be channeled into instruction.

The faculty member, faced with demands for greater productivity, is also weary confronting hundreds of traditional term papers to be graded. Librarians and faculty, collaborating on project design, can sift through the standard criteria and pick out those elements the faculty want to emphasize through the project so that it blends into the coursework. The teaching literature, whether library science or academic, is, of course, full of "how we done good" examples and ideas, as are the teachers' manuals that accompany the textbooks. In addition, LOEX and ALA regularly publish conference and poster sessions (e.g., see Harig et al., 1993). Some of the best ideas for assignments will be adaptations from other faculty projects, old faculty projects, and one's own college experience.

As the materials and methods available for library instruction multiply, the librarian is faced with ever more elaborate choices which must be grounded in knowledge of what students need to know in each particular discipline context (Campbell, 1989; Gratch, 1988; Harasim, 1990; Scheingold, 1991). These choices must be made in collaboration with the faculty based on shared experiences with the students. The lore and hype of data display, interactive video, hypermedia, primary documents, and portfolios need to be measured against clear descriptions and rationales for desired student behaviors (Lowry, 1990). A balance must be found between expectations for content and time restraints for instruction since "stuffit" so often becomes the paradigm: compressed time, compressed information, instant pudding-in-a-box. The librarian's responsibility is to teach research processes, not mechanized skills and, as difficult as it is, to evaluate the results of this intervention (Ackerson & Young, 1994; Flagg, 1990).

A large percentage of the literature on academic library instruction has borrowed, emulated, or reworked methods from the field of education (Edwards, 1994). The educator's knowledge base as practitioner includes classroom management, testing and measurement, content preparation, and a supervised student-teaching experience. The librarian's knowledge base in this area differs by a focus on the reference interview with one-on-one interaction, the organization and use of information, and networking skills. Although most library school programs include bibliographic instruction courses, there is little formal analysis of classroom management, differences in the kinds of teaching in the library and classroom, and basic distinctions in the interpersonal structures of the respective settings (Libutti & Gratch, 1995). Teaching faculty are concerned with "covering" and structuring content/data and therefore spend considerable time developing sequential experiences within their course syllabi. Librarians do the same but with differing emphases and constraints on time, evaluation, and content.

What is new here is what is actually new—electronic resources—and what is actually old reaffirming the apprentice-master process and the importance of the inquiry and scholarly metacognitive skills. Well-designed assignments will help students master library and research skills, require them to use higher-order thinking skills, and introduce them to current issues and materials in the discipline but always in the context of using the available technologies appropriately along the spectrum from interview and primary document to encyclopedia to Internet talk group. Exploring the variety of sources requires students to invest themselves—their effort, their time, and their perceptions—which leads to their ownership of the results. With a carefully sequenced and explicit assignment, students completing the work know for themselves whether they did it right, so that faculty, grading from the set of expectations, can work through the pile of papers very quickly, reserving their energy for incorporating report results into classroom discussion. Figure 4 illustrates the usually-not-linear progress from facts to a deep structure for the individual. Activities planned by faculty which focus on the apex of the knowledge/action triangle provide a student a chance to internalize the meanings of the research without the "right answer" dominating the resolution.

Argyris (1991) has stated that learning is not limited to problem-solving, formal or concrete. Instead, metacognition means, in the end, changing oneself rather than blaming externalities. In addition, an individual's preferences for search strategies are embedded in her culture and therefore have a multicultural dimension. Students have to confront their own construction of credibility, their own appreciation for diversity, precision, and ambiguity.

Library instruction, so often caught up in the specifics of each library, rarely emphasizes the layer of inquiry as the beginning point of an in-depth construction of knowledge. Although inquiry competencies are clearly within the tradition of research in education (Clandinin & Connelly, 1992), they also define the reference interaction. The library encourages the construction of self-directed learning on a scale not matched in any other learning environment. This student-centered approach has its best match in the open education/learning system (Rountree, 1994). The student is given parameters of inquiry, the environment is organized for many possible alternatives, and the teacher acts as coach/facilitator/research colleague. The public libraries of America have always been organized as open classrooms (Cheney, 1992); it is likely that the Internet will become the largest open classroom ever built.

Library instruction differs from course instruction, therefore, in both focus and organization. While the library instruction unit may indeed concentrate on one subject area and overlap the classroom experience, the purpose of undergraduate library instruction is to provide a structure for independent research, a structure which can be generalized across

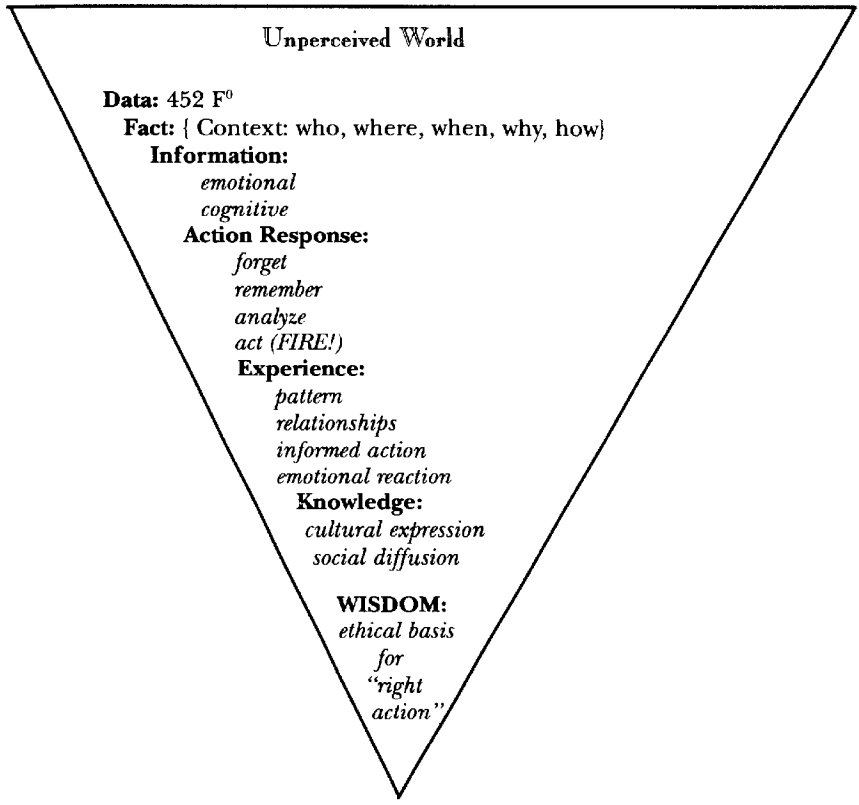

Figure 4. Knowledge/action triangle

content areas. Although college library instruction has taken many forms, it is, as an extension of the reference interview, maintaining the centuries-old tradition of the tutor (Lepper et al., 1993). This may explain why library instruction is so often justified by claiming that students, learning to do it themselves, will no longer need librarians' help. This denigration of the importance of librarian-student interaction reflects an insecurity about the librarians' role in the apprentice-journeyman-master process; librarians would benefit from re-reading the accumulated practitioner literature from a different viewpoint–that of the expert-tutor model.

Assignment Examples

The following examples of assignments currently being used in introductory courses combine faculty concerns with standard competencies. Each assignment is meticulously constructed to lead students through a series of searches which compile into the materials of the closely specified

final project. These assignments use several instructional design components and have been time-tested. The layers of learning have been integrated into each task, and the spectrum of knowledge needed has been articulated beyond that which is easily available. Note that the assignments vary with respect to ways students can learn from each other and involve a process designed to take the student from raw data through the stages to considered action. Hardest of all to build into the student project is a reverence for intellectual honesty, for the power of scholarship. And, more than imagination or empathy, wonder is a kind of sixth sense (Carlyle, 1834; Lasch, 1991; Stoehr, 1994) one should not abandon with childhood; successful assignments incorporate the powers of curiosity and appreciation, allowing students to experience the awe in the process and its results.

Even the best assignments need regular evaluation and renewal. No more than the Internet remains constant across the school year should the assignment be exactly repeated each semester. For instance, each project design needs to be evaluated each year in terms of librarian and faculty experience (How can it be done better?) and in terms of joint objectives and values (Is it still appropriate? Does it do the job?). Each year the librarians should actually walk through the assignment, testing the assumption that it clearly leads students through the process, through the resources and issues, and through the particular library. The personal benefit of this review is renewed contact with current information and scholarly sources and is, in effect, a micro-sabbatical on the subject.

Criminal Justice

In a Criminal Justice I and II course for beginning criminal justice students, the students use LEXIS online and the standard legal sets: U.S. Code, American Jurisprudence, ALR, and state equivalents. The first semester the students must research, individually, simple legal questions on LEXIS with support from the legal texts as they learn to understand head notes, citations, syllabi, and other keys to analyzing cases. The second semester, the students are assigned to small groups, two groups to each complicated mythical case; the rest of the class will sit as jury when the two groups, one defense and one prosecution, present the results of their work with LEXIS online, the law books, common sense, journals, and the *New York Times.* One group won a case that turned on whether a car had been borrowed or not by discovering that the car in question was worth more than $50,000. For the librarians and the students, this is an extremely time-consuming assignment, but it does indeed cover the real-life issues and competencies of the discipline and is, for most students, the highlight of their second semester.

TEAMWORK

Because teaming is a popular concept of the moment in management and health care systems, it is used as the format by faculty who teach, in one case, "Human Resources Management," and in another case, "Biology for Non-Majors." The groups are assigned urgent issues such as the Americans with Disabilities Act (which personnel officers must understand), or, for biology, trash incineration, which is a bitter local problem citizens need to address. Once again the assignments are spelled out in detail so that students review primary documents, conduct interviews, gather statistics and journal articles, survey the popular press and government documents, and prepare a class presentation which is graded using prestated scholarly criteria by the group, the class, and the professor.

PRIMARY DOCUMENTS

A popular device is to start each student with the analysis of a particular document (for instance, a table from the U.S. Statistical Abstract), an over-the-counter drug, a vignette from history, vital statistics from a particular township, or a provocative professional journal article (see, for example, Hall et al., 1994). The worksheet then specifies what information the student must collect, the way in which the data must be supported, the range of sources (print and online) that must be consulted, and how the student should analyze for conclusions, create context, and link to issues discussed in class. For instance, statistical tables can be linked to issues in sociology, state and local government, or economics; the drug formula illustrates issues in introductory chemistry; the vignette and vital statistics lead students into activities which introduce them to the methods of history (Blandy, In press).

BRIEF ASSIGNMENTS

For short projects, assignments may ask students to design a trivia birthday card for a friend, complete with bibliography for the professor who has specified sources to be used, or students may be asked to design an annotated Internet map, linear or graphed, which helps fellow students locate useful Internet sources. Students may be asked to prepare a handout of useful information sources for a local nonprofit group of their choice such as a hospice, literacy volunteers, or parents without partners. The short assignments, like the one-hour library instruction unit, must not be freighted with too many competencies and must be just as specific about expected activities as the longer projects.

CONCLUSION

Does all this make students smarter (or make the faculty and librarians more clearly intelligentsia)? Are academics, from apprentice to master, better informed about issues before recommending action (Sliwa, 1994)? Librarians and faculty in the electronic environment must be

learning along with the students, beyond motor skills, pattern recognition, and database construction to the strategies of the scholarly layer. The joy of moving from apprentice to journeyman, that is, from one who is held in the workshop to one who has earned the right to step out into the world, is a joy college faculty and librarians owe their students. In an information-dense world, the electronic environment of databases, Internet, distance learning, and interactive programs, as attractive as it is in its own right, is changing scholarship and the ways scholars share their concerns. The faculty themselves have changed the way they learn and then act, the way they use their expertise (Sliwa, 1994). Undergraduates now have access to mind-boggling amounts of information, most of it still obtained through the library at the prompting of faculty and course assignments. The library can serve as the laboratory of the mind in which students learn to frame their questions, gather sources, and evaluate the results with a chance to practice self-direction and independence of thought (Connell & Franklin, 1994). In this context, we can see how library-based research provides the means to work with, not lecture at, students and how the research process, while using all manner of sources, is based on the constants of clear thinking, verification, reflection, and serendipity. The mental processing that occurs as the cursor blinks will, across a lifetime, turn out to be as significant as the information that serves the moment.

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