

### CRITICAL SKILL FOR THE INFORMATION AGE

As the volume of information available and the speed with which it changes go into hyperdrive, being a critical consumer and manager of your information needs has become a basic skill. Adult, career, and vocational educators need this skill not only for their own professional development but also to be able to help learners acquire it. This *Practitioner File* reviews issues, myths, and misconceptions about information management. It describes two critical needs: the human skill of information literacy and the technical tools of information retrieval, including a comparison chart of search tools. It explains how your learning style affects information seeking and provides a bibliography and list of helpful websites.

**I've Got to Keep Up!** The twin demons of speed and quantity create an artificial sense of urgency: with e-mail, voice mail, fax, and the Web, continuous streams of data are possible 24 hours per day at work, at home, and during the commute between. The consensus of many sources is to forget about keeping up. Focus instead on what *you* really need to know and for what purpose, and understand that the question will evolve as you gather information. Ideal information is current, timely, and sufficient for the task at hand, not necessarily "complete" (Lively 1996). The goal of information seeking should be finding the answers to personally meaningful questions.

**It's All on the Web.** One myth rapidly taking hold is that the World Wide Web is a one-stop source for all information needs and the secret to information management is in knowing how to navigate it. The capacity for speed, quantity, and ease of access make the Web a highly attractive information source, and there is also what Wurman (1989) calls "aesthetic seduction," the graphical display that makes information look good. However, "a piece of information performs when it successfully communicates an idea, not when it is delivered in a pleasing manner" (*ibid.*, p. 125). Because everyone can (and seemingly does) publish on the Web, the responsibility for judging the quality, accuracy, and reliability of the content is on the receiver. Unfortunately, "research has shown that many people feel that information gained through a computer screen is more reliable than that from any other source" (Breivik and Jones 1993, p. 29).

The attraction of the Internet for some people is independence from authority (Nahl 1998). The lack of centralized quality control and the expansion of access may be good for democracy. However, web designers can manipulate what you see and retrieve, so the user must be more willing to challenge ideas and have the ability to judge the quality and accuracy of sources

*continued on p. 5*

### INFORMATION MANAGEMENT ISSUES

**Too Much Information?** The core problem of information management seems to be overload: determining the existence and location of resources in the chaotic repository that is the Internet, trying to learn the nuances of different software, retrieving far too many hits. However, some people question whether the problem really is overload. It may actually be the multiplicity of communication channels. Unlike earlier eras, new technologies are not replacing but adding to the host of media choices (Gilster 1997). The Web has simply removed natural barriers between people and information they would otherwise never see, and information now comes directly at us from multiple directions. Unfortunately, most traditional information management practices are too linear and specific: they were pipes developed for a stream, not an ocean (Alesandrini 1992).

Perhaps the issue is not too much information, but information that is not usable or meaningful. To master information you must understand the relationship between data, information, and knowledge: data are raw facts and figures, information is data organized into a meaningful context, and knowledge is organized data (i.e., information) that have been understood and applied. A resource such as the Internet requires *the user* to build content from its vast resources (Gilster 1997). People may perceive overload because the information they receive does not fit into their current mental models for understanding the world. A constructivist approach—interpreting new information in terms of existing knowledge structures and revising those structures accordingly—can help move those "analog" models into the digital world (*ibid.*).

### contents

Information Management Skills.....	2
Choosing and Using Search Tools.....	3
Information Management Tools.....	3
Search Engine Features Reference.....	4
Learning Style and Information Management.....	5
Bibliography.....	6

An underlying assumption of the information age is that individuals should possess information literacy, that is, they should have the skills to manage and use information. Such skills involve not only the ability to use technology to access information, but also—

- an attitude that appreciates the value and power of information;
- an awareness of the diversity of information resources and formats;
- an ability to use [multiple] information retrieval systems effectively to identify, locate, and obtain needed information and data;
- an understanding of how to use or manage information for some purpose by extracting, organizing, synthesizing, and evaluating what has been retrieved (Gratch and LaFrance 1994); and
- the ability to distinguish between information and knowledge (Uline 1996).

The skills associated with information literacy are not new. Using information effectively has always required a set of skills that includes thinking about the kind of information that is required; locating the information; evaluating, selecting, and organizing the information; and then using or applying it (Pappas 1997). What is new is how the Internet and the World Wide Web have changed how these skills are used as well as the degree to which they are required. For example, searching electronic databases—once the province of information professionals—can now be done via the Web by anyone with a minimum level of searching skills. Information technologies have also created a virtual flood of easily accessible information leading to a greater need for understanding the array of available sources.


What the Internet and Web have not changed is the need to be a critical consumer of information. “It is no longer a lack of information that is an impediment; rather, it is the abundance of information. . . . that makes the decision process more and more challenging” (Uline 1996, p. 29). The activities of information retrieval—as glamorous and seductive as they may be—cannot replace the activities of reflecting on, evaluating, and synthesizing the information (ibid.).

The amount of information available today coupled with the multiple avenues of accessing it may seem bewildering. The following tips can ease information

anxiety (Wurman 1989) by supporting efforts to manage information:


- **Become familiar with a few trusted sources of information.** Identify a few sources that provide reputable and reliable information. Information providers such as ERIC are in the business of collecting, organizing, and synthesizing information and can serve as initial filters of information. They can also point you in the direction of other sources.
- **Develop searching skills.** Mastering a few basic searching skills can improve information retrieval. Taking time to understand such concepts as the scope and coverage of a database, search engine, or index; the use of natural language versus controlled vocabulary; and the process of defining a search strategy will pay dividends as these concepts can be applied in searching a number of electronic information sources (Gratch and LaFrance 1994). (See “Choosing and Using Search Tools” on p. 3 and “Search Engine Features Reference” on p. 4 for specific tips on searching.)
- **Be a critical consumer.** The adage “buyer beware” needs to be applied to the results of any information search. Keep in mind that not all information is equal and that information may carry bias (Weisburg and Toor 1994). Although information from all sources should be scrutinized, “for uncritical users, the World Wide Web can be a tangle of misinformation” (Caruso 1997, p. 24). Criteria that can be used in evaluating any information include the following: Who—what is the authority? What—what is being said? When—how current is the information? and Where—who is the publisher or what is the location of the site? (ibid.).
- **Invest time in synthesis.** The ease with which information can be collected and compiled can disguise the fact that the synthesis process still takes time. Until the information is analyzed and synthesized, it remains simply a compendium of data. It requires the “human agency” of reflection and translation into something more or it will simply be “information for information’s sake” (Uline 1996, p. 31).

In the information age it is sometimes easy to forget that information skills developed in an earlier era are still valid. The basic tools may have changed but some of the ways of thinking about and acting on information remain unchanged.



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## CHOOSING AND USING SEARCH TOOLS

Searching the Internet can lead to the discovery of a wealth of information on every imaginable topic. Searching it *effectively* leads to finding information that is needed and wanted. A variety of search tools exist that make the task of finding information and materials relatively easy, once the features that they offer have been mastered. In this article, no attempt is made to discuss or describe all search tools. The Web indexes listed here and in the chart on page 4 can be used to identify additional search sites. Try different ones to determine which is the best for a particular need.

*Web indexes* or directories are like a card catalog. The contents are organized, evaluated, based on a thesaurus and are like familiar library tools. One disadvantage is that only a limited number of websites are indexed. Examples of Web indexes include Yahoo! <[www.yahoo.com/](http://www.yahoo.com/)>, Internet Sleuth <[www.isleuth.com/](http://www.isleuth.com/)>, and Magellan <[www.mckinley.com/](http://www.mckinley.com/)>. They will all lead to search engines.

*Search engines* typically offer a search form onto which words or phrases are entered. Automated search software looks for those websites that include the terms entered. Examples of search engines are AltaVista <[altavista.digital.com/](http://altavista.digital.com/)>, HotBot <[www.hotbot.com/](http://www.hotbot.com/)>, and InfoSeek <[www.infoseek.com/](http://www.infoseek.com/)>. Although searches may retrieve buried information, often too much

material is found. Using the advanced features of an engine can help in narrowing a search.

When using any of the search tools, it is important to consult the “Help” section to learn about a tool’s idiosyncracies and defaults. Most tools allow searching by keyword and support Boolean operators (AND, OR, NOT) and truncation (e.g., using the keyword <*lead\**> results in finding sites that include the terms *leader*, *leadership*, and *leading* as well as *lead*). Unless you use quotes for a phrase, the default in most search engines will be OR. If you enter the term *vocational education*, for example, the result will be sites that contain either the term *vocational* OR the term *education*; using quotes around the term (“vocational education”) will result in finding those sites with only the whole term.

Many of the search engines have advanced features that allow for more precise retrieval of information. They support proximity searches (terms occurring close to each other), field searching (by date, title, host, domain, language, and so on), and word stemming or truncation. AltaVista offers translation services.

Finding information on the World Wide Web has been compared to finding a needle in a haystack. Taking the time to investigate various search tools and learning about their particular features will help you find what you’re looking for with more precision.

## INFORMATION MANAGEMENT TOOLS

Current and future technical tools that can help you manage information are described here.

**Intelligent Agents.** Intelligent agents are computer programs that assist the user with applications such as e-mail, maintaining a calendar, and filing. They act as intelligent, personal assistants, filtering information according to parameters set by the user and gathering it automatically (Jansen 1997; “Wise Up” 1998; Wolfe 1998).

**Metadata.** Metadata are descriptive information about an information resource that represent its knowledge content, intellectual property, and cataloging information (Greenberg 1998). Metadata can be compared to the information that is found on a library catalog card; they include such elements as author, title, source, date, subjects, description, language, publication type, and format. Researchers are working on standardizing this information to aid in cataloging websites. One such project is the Dublin Core <[http://purl.oclc.org/metadata/dublin\\_core/](http://purl.oclc.org/metadata/dublin_core/)>.

**PUSH Technology.** Push technology downloads information from the World Wide Web automatically

to your computer (Andrews 1997; “What Is” 1997). Typically, individuals subscribe to a publisher’s website. They fill out a profile indicating what type of information is needed/wanted. The server then scans the Web and “pushes” the information to the subscriber’s machine. Some of the companies offering this service are listed here (Williams 1997). The Web addresses are of demos that can be downloaded. For some services there is a charge; others are free.

**PointCast** <<http://pioneer.pointcast.com/download>>  
**Intermind Communicator** <[http://www.intermind.com/prod\\_demo/download.html](http://www.intermind.com/prod_demo/download.html)>  
**BackWeb** <<http://www.backweb.com/dl/download.html>>  
**Castanet** <<http://www.marimba.com/tunein>>  
**After Dark Online** <<http://www.afterdark.com/htmls/download.html>>

Other improvements to the “information infrastructure” are or should be in the works: “middleware” such as pipe managers that control the speed, security, and reliability of data flow; hyperorganizers/finders; and 3-D displays; and scatter/gather interfaces that cluster results into groups based on their similarity to one another (Dertouzos 1997; “The Internet” 1997).

**SEARCH ENGINE FEATURES REFERENCE**  
**(LAST EDITED AND VERIFIED: OCTOBER 25, 1998)**

Search Engine	Address	Include/Exclude Shortcuts		Boolean Operators Supported					Selected Features
		Include	Exclude	AND	OR	NOT	phrase	group	
AltaVista	www.altavista.com	+	-	✓✓	✓✓	✓✓	"..."		* wildcard, multip
DejaNews*	www.dejanews.com	&	&!	✓✓	✓✓	AND NOT	"..."	(...)	only searches Use
Excite	www.excite.com	+	-	✓✓	✓✓	AND NOT	"..."	(...)	Index, "more like
HotBot	www.hotbot.com	+	-	✓✓	✓✓	✓✓	"..."	(...)	menu shortcuts, in
Infoseek	www.infoseek.com	+	-				"..."		case sensitive, ind
Lycos	www.lycos.com	+	-	✓✓	✓✓	✓✓	"..."		ADJ, NEAR, FAR,
Magellan	www.mckinley.com	+	-	✓✓	✓✓	AND NOT	"..."	(...)	Index, "Green ligh
Search.com	www.search.com	+					"..."		case sensitive, ind
Webcrawler	www.webcrawler.com	+	-	✓✓	✓✓	✓✓	"..."	(...)	
Yahoo	www.yahoo.com	+	-				"..."		* wildcard, date ra

**Operator Quick Reference**

**AND or +**

*examples:* James AND Bond                      cats AND dogs                      Sonny AND Cher                      New AND England AND fall  
 +James +Bond                      +cats +dogs                      +Sonny +Cher                      +new +England +fall

**NOT or -**

*examples:* Kennedy NOT assassination                      antiques NOT clocks                      Clearwater NOT Creedence                      peanut NOT butter NOT brittle  
 +Kennedy -assassination                      +antiques -clocks                      +Clearwater -Creedence                      +peanut -butter -brittle

**OR**

*examples:* email OR e-mail                      vacumn OR vacuum                      Houston OR Dallas                      elm OR poplar OR oak

**phrase**

*examples:* "Green Eggs and Ham"                      "Happiness is a warm puppy"                      "adult literacy and technology"                      "Declaration of Independence"

**grouping**

*examples:* (apple OR pecan) AND pie                      (IBM OR Macintosh) AND computer                      ("Bill of Rights" OR "Magna Carta") AND online

It has been said that the World Wide Web and other hypermedia-based systems are modeled on the way the brain processes information (Small and Ferreira 1994). Individuals process information by using distinctive patterns known as learning styles to select, organize, and store it. One way to categorize learning styles is analytical and global (Flannery 1993). Analytical or Field Independent (FI) learners process information sequentially, use logical inductive processes, and perceive information in an abstract, objective manner (*ibid.*). Global, right-brain learning processes are deductive, intuitive, concrete, and subjective. Global or Field Dependent (FD) individuals use their entire surroundings—including other people—to process information.

Researchers have found a relationship between learning styles and approaches to using hypermedia. Much of the hypermedia research compares FI and FD individuals. Although hypermedia integrate aural, visual, and textual elements that accommodate various learning styles, most findings (Chou and Lin 1997; Cline 1991; Hsu et al. 1991) show that FIs perform more efficient searches in shorter time and are more comfortable jumping around (“surfing”). FDs more often report feeling disoriented or lost, navigate more linearly (frequently using Back or Home keys), and tend to follow sequences instead of jumping around. This may be because FIs use active approaches such as hypothesis testing; form mental models of how the Internet is constructed and information is organized, revising them continuously; use metacognitive strategies (planning, monitoring, reflecting, regulating); and transfer concepts and search methods to new situations. FDs prefer to be guided and want a global overview, such as explicit menus listing all possible choices (Chou and Lin 1997). Liu and Reed (1994) found that both FIs and FDs perform well, but approach the task differently.

Other variables affect information-seeking processes: motivation, perceived importance or value of information, self-efficacy, emotions, prior computer experience or subject knowledge, degree of self-direction, and design of the interface (Hsu et al. 1994; Nahl 1998; Small and Ferreira 1994). Some learners adapt their preferred style to the one called for by the situation (Flannery 1993).

Cline (1991) envisions a day (perhaps not far off) when we will carry cards coded with learning style information and individual profiles that we will plug into a machine, which will adapt itself to our preferred style. Meanwhile, researchers are developing new tools such as the SketchTrove system, in which one side of the screen allows browsing, the other analytical strategies

*continued on p. 6*

## ISSUES *continued from p. 1*

(Gilster 1997). In addition, the Web encourages breadth over depth. As with any information source, critical information literacy is vital, and users must be wary of overreliance on any single source. The Web may have eliminated the “middleman” but not the need for one. Neither should “offline” sources be neglected.

**Just Build a Better Mousetrap.** One school of thought holds that better ways of structuring and retrieving information will help curb the information monster. What we need now is information *about* information: cues provided by layout, typography, interaction method, color, etc. “Metadata,” electronic labels that describe aspects of Web content beyond the “page” metaphor, are being developed to orient users to what can be found at a site (see p. 3). Flexible design would also help. Marchionini (1995) advocates alternative interfaces that allow information seekers to choose strategies according to their immediate needs.

Although search engines and indexes provide some structured means of retrieving specific information, they are in many ways imperfect (Gilster 1997; “The Internet” 1997): being machines they overindex, excluding little; they provide uniform and equal access to everything; they do not always extract the right information because websites are not standardized; their relevancy rankings may be arbitrary; and they largely index text only. In addition, many providers are involved with transmission and storage, but too few are devoted to facilitating understanding (Wurman 1989). Translators and interpreters who focus on making information accessible and comprehensible are needed.

Some do not necessarily see salvation in better retrieval methods. Sometimes, we become “so enamored of our tools that we are enticed to use them simply because we *can*” (Uline 1996, p. 31). Navigation of information sources is emphasized over critical analysis, integration, and application.

**The Answer Is Knowing the Right Questions.** The problem of information management has both technological and human aspects. The solution is also two pronged: both technological—create better tools and make better use of them—and human—revise mental models and sharpen the capacity for critical reflection and analysis. The core competency of information literacy is “developing the habit of critical thinking and using network tools to reinforce it” (Gilster 1997, p. 33). Some strategies for finding your way through the data smog include the following: (1) be your own filter—turn off unneeded data streams; (2) be your own editor—ask whether the information you disseminate is absolutely necessary; (3) use both a wide-angle and a zoom lens; and (4) know your learning style and how it affects your approach to information (Alesandrini 1992; Shenk 1997).

- Abernathy, D. J. "Sharpen Your Search Tools." *Training & Development* 52, no. 8 (August 1998): 18-19.
- Alesandrini, K. *Survive Information Overload*. Homewood, IL: Business One Irwin, 1992.
- Andrews, W. "Planning for Push." *Internet World*, May 1997, pp. 45-52.
- Breivik, P. S., and Jones, D. L. "Information Literacy." *Liberal Education* 79 (Winter 1993): 24-29. (EJ 464 246)
- Calishain, T. "Channeling Your Message." *Internet World*, February 1998, pp. 59-62.
- Caruso, C. "Before You Cite a Site." *Educational Leadership* 55, no. 3 (November 1997): 24-25. (EJ 553 829)
- Chou, C., and Lin, H. "Navigation Maps in a Computer-Networked Hypertext Learning System." Paper presented at the Annual Meeting of the Association for Educational Communications and Technology, Albuquerque, NM, February 12-16, 1997. (ED 403 882)
- Cline, J. A. "Cognitive Style in System Design." Master's thesis, Kent State University, 1991. (ED 343 586)
- Dertouzos, M. *What Will Be*. New York: HarperEdge, 1997.
- Flannery, D. D. "Global and Analytical Ways of Processing Information." *New Directions for Adult and Continuing Education* no. 59 (Fall 1993): 15-24. (EJ 472 127)
- Gilster, P. *Digital Literacy*. New York: Wiley, 1997.
- Gratch, B., and LaFrance, H. "Teaching Information Retrieval Skills to Adult Students." In *Forging Connections in Adult Higher Education*. Washington, DC: American Council on Education and the Alliance, 1994. (ED 413 445)
- Greenberg, J. Metadata Standards Workshop, Centerville, OH, July 31, 1998.
- Hendry, D. G., and Harper, D. J. "An Informal Information-Seeking Environment." *Journal of the American Society for Information Science* 48, no. 11 (November 1997): 1036-1048. (EJ 552 585)
- Hsu, T. E.; Frederick, F. J.; and Chung, M. L. "Effects of Learner Cognitive Styles and Metacognitive Tools on Information Acquisition Paths and Learning in Hyperspace Environments." In *Proceedings of the 16th National Convention of the Association for Educational Communications and Technology*, edited by M. R. Simonson et al. Washington, DC: AECT, 1994. (ED 373 721)
- Jansen, J. "Using an Intelligent Agent to Enhance Search Engine Performance." *First Monday* 2, no. 3 (March 3, 1997). <[http://www.firstmonday.dk/issues/issue2\\_3/jansen/index.html](http://www.firstmonday.dk/issues/issue2_3/jansen/index.html)>
- Junion-Metz, G. "Internet Search Strategies." OHIONET workshop, Columbus, OH, February 6, 1997.
- Junion-Metz, G. "Web Supersearcher: Advanced Search Strategies." OHIONET workshop, Columbus, OH, October 16, 1998.
- Liu, M., and Reed, W. M. "The Relationship between the Learning Strategies and Learning Styles in a Hypermedia Environment." In *Proceedings of the 16th National Convention of the Association for Educational Communications and Technology*, edited by M. R. Simonson et al. Washington, DC: AECT, 1994. (ED 372 727)
- Lively, L. *Managing Information Overload*. New York: AMACOM, 1996.
- Marchionini, G. *Information Seeking in Electronic Environments*. Cambridge: Cambridge University Press, 1995.
- Nahl, D. "Learning the Internet and the Structure of Information Behavior." *Journal of the American Society for Information Science* 49, no. 11 (September 1998): 1017-1023.
- Pappas, M. L. "Organizing Research." *School Library Media Activities Monthly* 14, no. 4, (December 1997): 30-32. (EJ 555 825)
- Shenk, D. *Data Smog*. New York: Harper and Collins, 1997.
- Small, R. V., and Ferreira, S. M. "Multi-media vs. Print Information Resources: Information Location and Use, Motivation, and Learning Patterns for Children and Adults." In *Proceedings of the 16th National Convention of the Association for Educational Communications and Technology*, edited by M. R. Simonson et al. Washington, DC: AECT, 1994. (ED 373 763)
- "The Internet: Fulfilling the Promise. Special Report." *Scientific American* 276, no. 3 (March 1997): 49-83.
- Uline, C. L. "Knowledge in the Information Age: Effortless Communication and the Effort of Reflective Thought." *Educational Technology* 36, no. 5 (September-October 1996): 29-32. (EJ 531 097)
- Vaughn-Nichols, S. J. "Find It Faster." *Internet World*, June 1997, pp. 64-66.
- Weisburg, H. K., and Toor, R. "The Information Curriculum: Teaching Concepts for the Virtual Library Environment." *School Library Media Annual (SLMA)* 12 (1994): 63-69. (EJ 495 181)
- "What Is 'Push Technology'?" Advanced Technology Group, August 6, 1997. <<http://jm.acs.virginia.edu/departments/org/atg/techtalk/push/present/sld005.htm>>
- Williams, A. "Go Ahead, Push Me!" *Win95 Magazine*, July 1997. <[http://www.win95mag.com/97\\_07/html/push.html](http://www.win95mag.com/97_07/html/push.html)>
- "Wise Up: Find Out What Intelligent Agents Can Do for You." *Internet Week*, June 29, 1998, p. PG45.
- Wolfe, W. "Agent-Based Planning and Scheduling Systems." 1995. <<http://carbon.cudenver.edu/~wwolfe/agents.html>>
- Wurman, R. S. *Information Anxiety*. New York: Doubleday, 1989.

## WEB RESOURCES

ERIC Clearinghouse on Adult, Career, and Vocational Education website includes full text of ERIC/ACVE publications and links to the ERIC database. <<http://ericacve.org>>

Critical Thinking Skills/Evaluating WWW Sites (Peru State College Library) contains a list of links to evaluation sites. <<http://www.peru.edu/libresources/thinking.html>>

A Primer on Digital Literacy adapted from the book by Gilster (1997) includes exercises for developing digital literacy skills. <<http://sunsite.unc.edu/cisco/noc/primer.html>>

National School Network Site Evaluation includes network members' reviews of education-related websites. <<http://nsn.bbn.com/webeval/site1.htm>>

## STYLES *continued from p. 5*

(Hendry and Harper 1997), or 3-D displays that enable the visualization of information from a variety of perspectives simultaneously ("The Internet" 1997). The keys to successful information retrieval are to recognize the implications of your preferred learning style; know how to select and use hypermedia tools such as indexes and search engines, that match your style; learn to adapt style to situation; and develop the ability to create mental models and use meta-cognitive strategies.



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