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Avoiding the Cereal Syndrome

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Avoiding the Cereal Syndrome, or Critical Thinking in the Electronic Environment

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ABSTRACT

ADVANCES IN TECHNOLOGY have allowed the "supercatalog" to move from an idea to a reality. With its multiple databases and integrated structures, the supercatalog offers access to more information more easily than ever before. For all the advantages that this new technology offers, there are also problems that must be recognized and confronted. The most serious of these is that users must choose from a multitude of possibilities in order to fulfill their information needs. Research about consumer tolerance for making choices, whether about cereals or databases, suggests that "more is less," not "more is more." Thus, it is imperative that librarians adequately prepare users with the critical thinking skills that are necessary to take advantage fully of the new electronic environment. More than ever, critical thinking must become the core of bibliographic instruction.

When George Orwell (1949) penned his now famous phrase "Freedom is Slavery," he was not thinking about the emergence of a sophisticated integrated information retrieval system. Yet, his dystopian vision of a world where choice results in individual confusion and anxiety presages at least one of the critical issues emerging from our increased abilities to provide access to a wide range of information easily and transparently—i.e., making choices.

This problem is not limited to online information systems. Indeed, it is becoming a growing area of concern in our everyday lives. Perhaps an illuminating, if mundane, example of this problem

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is evident in the extraordinary increase of items available in the supermarket. Not surprisingly, the overwhelming availability of competing items to choose from in the supermarket, according to one study, results in increased anxiety among shoppers (Williams, 1990). This was borne out recently by a story a friend relayed to me. He had gone to the grocery store to pick up his favorite cereal. The endless aisles of different types of cereals so overwhelmed and frustrated him—he could not find his favorite brand—that he abandoned his cart mid-aisle and went to a small corner grocery that had far fewer choices. He was a victim of the "cereal syndrome." Much to the dismay of hypermarkets everywhere, all indications seem to support the conclusion of David A. Gosline, president of the American Institute for Research, that: "Choices do not make life easier; they make it more difficult for all of us" (Williams, 1990, p. C1).

The problems of choice facing consumers in the grocery store are not that different from the problems of increasing choice which face students and faculty in the emerging online library environment. Libraries, armed with the latest technological breakthroughs, have begun to reshape access patterns to information. The one pattern which has become the sine qua non of libraries is the building of the "Supercatalog." The supercatalog, according to Shaw (1988): (1) is distant-independent, (2) contains multiple collections residing on one computer (or accessible via a network), and (3) has access points only limited by content of record. The idea of the supercatalog is attractive: a single access point, available from any microcomputer, which can provide the user with information about local library holdings, and electronic gateways to other library holdings, periodical abstracts and indexes, national bibliographic utilities, encyclopedias, etc.

This online library, well advanced beyond the online catalog, opens opportunities for the user unimagined as recently as twenty-five years ago. Shaw (1988) asserts that this new catalog offers "nothing short of improving the quality of both learning and research." But he hastens to add that "we do not yet understand either learning or research well enough to know much about how to approach the task" (p. 143). Clearly this new supercatalog presents a number of interesting and challenging problems, not the least of which is the overwhelming number of choices presented to the user. Users may soon be confronting the library equivalent to the "cereal syndrome." More important, perhaps, is the question that the situation provokes: How do we ensure that students are equipped to harness the extraordinary powers of this new online environment? The answer to this question lies in bibliographic education.

The emergence of the supercatalog is one of the most important consequences of computer and telecommunication technologies. Schill (1987) was correct when he suggested that the wiring of the university is "the most significant area for library administrators and instruction librarians to monitor" (p. 443). The wiring of the university and the concomitant emergence of new information structures are indeed two of the most influential environmental elements influencing higher education. Furthermore, their impact on instruction librarians and the design of instruction has been, and will continue to be, acute.

The online public access catalog, the first major component in the new online library, spurred much discussion and experimentation in teaching methods and formats. What was instantly apparent was that, "the mere presence of an online catalog often create[d] a false sense of confidence concerning the comprehension of its content and the knowledge required to use it effectively" (Baker, 1986, p. 36). Borne out by a number of other studies, the online catalog was viewed as a panacea by users, regardless of their success in locating relevant materials. The lure of technology had made itself felt. The conclusion of a study of user information-seeking behavior at Bowling Green State University, for instance, indicates that "automation (i.e., online public access catalog, OCLC, optical disks) attracts—and it attracts even the user who has infrequently used library reference sources" (York, 1988, p. 16).

Perceived user happiness, though a desirable by-product, is not acceptable from an instruction librarian's perspective (nor should it be acceptable to researchers). Users must understand the online environment. Specifically, as Baker (1986) asserts, the user must be able to: (1) understand the function and purpose of the online catalog; (2) define the scope of the catalog; (3) understand selected concepts of an online information retrieval system; (4) structure an online catalog search by choosing, entering, and manipulating search vocabulary; and (5) interpret the results of a search and identify information from it that is pertinent to the user's information needs. By adopting the database itself as the conceptual model for teaching online retrieval, Baker and Sandore (1988) have concentrated on identifying and teaching concepts which are unique to the online environment (e.g., Boolean searching, command structure, controlled vocabulary versus free-text searching, command language). The articulation of concepts unique to the electronic library underscores the additional skills which students must possess to operate successfully in this new environment.

A number of studies at academic libraries illustrate the dismal abilities of students, at the most basic level, of being able to match

their subject needs with appropriate computer retrieval systems. At the Undergraduate Library of the University of Illinois at Urbana-Champaign for instance, eighty-two searches conducted on CD-ROM databases were reviewed and analyzed by three judges for suitability and appropriateness of database in relation to the subject content. Users had a selection of sixteen CD-ROM databases to choose from; only 22 percent of the searchers selected databases deemed appropriate for their search topic. Almost 20 percent of the users selected databases considered to be not even one of the three most suitable databases (Allen, 1990). At the University of North Carolina's Undergraduate Library a series of interviews with InfoTrac users revealed that 9 percent of those interviewed were trying to use InfoTrac for researching such topics as Graham Greene, Spanish American War, and Kierkegaard (Momenee, 1987).

In other words, if these studies are typical of other user groups, the most basic critical thinking skills required for matching subject relevance with appropriate sources of information are sorely missing in the vast majority of undergraduates. These are not revolutionary findings. Quite the contrary. The same statistics would no doubt be duplicated in an examination or selection of print indexes/abstracts. What is significant, however, is that unlike print reference tools, which for the most part remain singular in form and format, the online environment is hurtling toward a totally integrated information network in the form of a supercatalog. This integration, which promises transparency of access to millions of information bits, has several possible outcomes: (1) it will be embraced warmly and enthusiastically for bringing the information to the user, not the user to the information. More than likely, this reaction will be from knowledgeable informed users who can easily distinguish which, among many information retrieval options, are appropriate; (2) it will be embraced enthusiastically from a misguided perception that all information is dispensed through the supercatalog (a misperception already evidenced in studies of online public catalogs and InfoTrac); and (3) it will be a replication of the "cereal syndrome" which results in increased anxiety and avoidance.

It is interesting to note that in Huston and Oberman's (1989) study of information-seeking novices, there is a marked contrast between their affective behavior in searching for information outside the database environment and in the database environment itself. When gathering information to support a project outside the online environment, students represented their efforts as "alive" and "happening." This is attributed to the "living, human nature of the information providers who were functioning, as 'interfaces' between the bodies of knowledge and the requestors of information"

(p. 205). When the same students were asked to use manual and online methods to gather information, their mental state was significantly changed and they expressed either qualified success or dissatisfaction. These findings seem to support Mellon's (1986) qualitative study of students' reactions to library use. Through an extensive sampling of students' experiences in using the library, Mellon concluded that "when confronted with the need to gather information in the library for their first research paper, many students become so anxious that they are unable to approach the problem logically or effectively" (p. 163). The addition of electronic access may indeed serve to magnify students' anxieties.

The most extensive examination of students' affective behavior in conducting library-based research was done with elementary and secondary school students. In a series of longitudinal studies over a five-year period, Carol Kuhlthau (1987) plotted the library research process of these students. Her research revealed six stages which these students progressed through in their process of gathering information:

1. task initiation characterized by feelings of uncertainty and apprehension;
2. topic selection characterized by optimism;
3. prefocus formulation characterized by confusion and frustration and strong doubts about individual ability to complete the task;
4. focus formulation characterized by the emergence of a central theme;
5. information collection characterized by a sense of direction and increased confidence;
6. search closure characterized by relief, satisfaction, and accomplishment.

Kuhlthau's (1988) research process model offers some interesting insights into student emotional behavior when pursuing the unknown. The third and fifth stages of the model in particular—prefocus exploration and information collection—offer a unique insight into the problems of choice and selection. It is in these two stages of the search process that students confront a series of choices; their reactions are telling. In the prefocus exploration stage, students seek a focus for their topics. According to Kuhlthau, their feelings are characterized by "confusion, doubt, sometimes threat, uncertainty" (p. 238). Yet the actions and strategies identified to overcome their feelings include finding and reading additional information, identifying relevant descriptors, and taking notes.

In the initial information collection stage, students must locate materials which support their focused topics. Their feelings are characterized by "realization of extensive work to be done, confidence

in ability to complete the task, and increased interest" (p. 240). Their actions and strategies directly involve using the library for conducting a successful search for materials, using a variety of reference tools, and seeking assistance from a reference librarian.

What is of particular interest is that students in the Kuhlthau study exhibit an increased sense of confidence once they have completed the focus stage of their research—that is, once they have completed making their choices. The information collection stage, marked by confidence and increased interest on the part of the students, may, at best, be illusory. Kuhlthau is not studying the quality of the student products, rather their affective and cognitive processes. But if the studies cited earlier are general indicators of student inabilities to understand the online environment—its complexities and its dimensions—then perhaps, in that domain too, their ignorance will be fueled by a naive confidence.

The significance of Kuhlthau's work is that it provides a road map of student thinking at each stage of the research process. Additionally, it provides a potential yardstick by which students can gauge their state of mind and recognize that as each stage is completed a growing sense of confidence and accomplishment will emerge. Among other things, Kuhlthau's study suggests that the process of research is often filled with ambiguities and uncertainties. Finally, she proposes that once students understand that research is not a linear process, they can proceed with reassurance and security. By understanding the process, students will be better prepared to be successful.

This affective study, limited as it is to elementary and secondary students, is precisely the type of study which needs to be conducted for the electronic information environment.[1] Investigation, particularly during the information collection stage, might yield some important insights into whether the networked environment is the seductive creature it is currently perceived as, or whether, as the networked environment becomes more intricate and interwoven, students will recognize its complexities and feel overwhelmed rather than comforted by it.

It is too presumptuous to assume that we are creating an online library environment which will result in a higher level of anxiety and confusion for users. This is borne out by a recent study of user persistence in scanning references. Wiberley and Daugherty (1988) conclude that, "maximizing retrieval...can lead to [information] excess" (p. 154). Information excess can lead to intellectual distress. It was found that end-users preferred to receive limited search results

(between thirty and seventy citations). It was also found that end-users would commonly abandon the search for information entirely if provided with more references than they were willing to scan.

Even skeptics about the impact of information overload recognize its potential problems. Rudd and Rudd (1986), for instance, assert that the issue of information overload is much overrated and there is little empirical evidence to suggest that increased amounts of information have an effect on the quality of the decision-making process. However, they do take time to suggest a four point model to prevent users from possible information overload: limiting information by type, date, etc.; minimizing time users spend in locating desired materials; developing and refining users' skills through instructional programs; and, finally, selecting and evaluating information.

These skills demand significant critical thinking skills on the part of the user. And indeed, it is these new skills which are the heart and soul of the conceptual movement of bibliographic instruction. They have been embraced by an ever increasing number of practitioners and, most recently, have been codified by the Association of College & Research Libraries (ACRL) Bibliographic Instruction Section (BIS) in their *Statement of Model Objectives for Academic Bibliographic Instruction* (1987). The ACRL BIS "Statement of Model Objectives" is not specifically written for the electronic environment. The statement is, however, intended to cover all concepts which are essential for students to understand and to handle effectively the ever growing system of information opportunities, including the electronic environment.

Recognition of the importance of concepts to bibliographic instruction has been a rite of passage for the instructional movement. It has released library instruction from a limited tool-bound and preset formula approach to an unlimited information-based and realistic approach. Theoretically, this new approach should introduce students to the vagaries of research and equip them to handle the unlimited choices of information sources and search possibilities available to them in the expanding information universe. But does it?

Concepts alone do not seem to be the answer. Anecdotal evidence from instruction librarians across the country suggests that, while practitioners are eager to incorporate conceptual approaches into their instruction, they are often disappointed in the response of their students.[2] Frequent complaints are that "They don't seem to understand," that "They need the basics before they are ready for concepts," and that "They cannot apply the concepts once they are in the library."

The teaching of concepts (including, for example, evaluation of materials, publishing cycles for disciplines, selection of information sources, development of a database search strategy) can only be successful if it is recognized, as Rudd and Rudd (1986) did in their discussion of information overload and the decision-making process, that concepts inherently require students to use critical thinking skills. Most importantly, critical thinking skills cannot be taken for granted, even among college students.[3]

If instruction librarians examine the concepts that have been articulated as important to instructional efforts (e.g., Oberman & Strauch, 1982; Beaubien, et al., 1982; Reichel & Ramey, 1987; Baker, 1986b, among others) it is clear that most of these concepts demand that students operate in the world of abstraction. McInnis's (1982) use of metaphors to discern the relationship of publications to one another, Keresztesi's (1982) description of the growth of a discipline and its parallel bibliographic structure, and Baker's (1986a) database as a conceptual model are all exemplary conceptual approaches to library instruction. In every instance, however, students must engage in what is most likely unfamiliar cognitive territory. As such, library instructors' expectations may exceed students' cognitive abilities.

Library instruction, over the years, has slowly shifted its focus. Its initial concerns were with the lowest cognitive objectives, as classified by Bloom (1984), of knowledge (representing lowest level of learning outcomes, such as recalls of specifics and universals), and comprehension (representing the lowest level of understanding, which does not require establishing relationships to other material). Emphasis is now, appropriately, on the highest cognitive objectives of analysis (ability to break down materials into their component parts so that their organizational structure can be understood), synthesis (ability to reassemble elements or parts to formulate new patterns or structures), and evaluation (ability to judge the value of materials on definite criteria). Analysis, synthesis, and evaluation are all cognitive objectives which demand students to think.

The cognitive skills of analysis, synthesis, and evaluation are nowhere more obviously needed than when students encounter the online information environment. Numerous studies (see earlier discussion) suggest that some students view the online environment as a means of circumventing traditional mechanisms for understanding the relationships between their information needs and information resources. Others face the online environment with trepidation and confusion. Both of these problems may only become exacerbated by the emergence of the supercatalog.

Thus, it is more critical than ever that we recognize the complexity of information concepts and the limited abilities of our students to

adequately understand and apply them. The networked environment, the supercatalog, and the proliferation of microcomputers are moving us toward a "disembodied" library. If the future does indeed take the form of "a single, unified electronic record of scholarship...," as Eldred Smith (1990) suggests in his recent essay, *The Librarian, the Scholar, and the Future of the Research Library* (p. 67), then students need to understand more than what they see on the computer screen. They also must understand a combination of the "how, who, why, and where" of bibliographic concepts and how to search and select from a vast repository of information. If they do not understand the concepts, if they cannot critically apply them, we may be faced with the paradox of building a marvelously sophisticated information apparatus that only a limited few can fully understand and use.

What then is the proper educational response to the online information environment? It must be a new combination of methodology and pedagogy.

Methodologically, instruction librarians must place the online environment in the broader context of the information world. As such, the online environment, and the concepts which are unique to its manipulation, must not exist in an information vacuum. The relationship between the concepts unique to information systems must be interwoven and connected to the broader concepts of information generation, access, and evaluation. The ACRL BIS "Model Statement of Objectives" specifically (and rightfully) ignores singling out the online information environment in hopes of encouraging instruction librarians to approach information as an entire package of interrelated concepts. This methodological approach should provide users with all the important concepts which must be understood and applied in or out of an electronic environment.

Perhaps more radical is the pedagogical implication. While the world of information may be becoming more complicated, the cognitive skills necessary to successfully operate within it remain the same. What needs to change are the teaching methods that instruction librarians use to prepare students to face the contemporary world of information. The complexity of the online environment has given new impetus to this need. It is time to recognize that concepts of bibliographic instruction are complex and abstract. It is time to recognize that most students are not formal thinkers and, therefore, cannot automatically translate abstract concepts into practical applications. It is time to recognize that the cognitive objectives of analysis, synthesis, and evaluation must be overt educational goals.

Finally, it is time to experiment with teaching methodologies, such as active learning, which places primary importance on promoting thinking.

Active teaching, which results in active learning, offers an opportunity for students to discover the concepts which they will need to operate in an information rich environment. Active teaching is a pedagogical tool that assists students in drawing on their own experiences as a bridge to new experiences. It is a tool that allows students to discover and apply concepts to the problem at hand. Most importantly, it is a tool which explicitly demands that students think critically and act creatively.

There are many forms of active learning, all of which are aimed at stimulating abstract and critical thinking.[4] But all of these active learning models rely on four key components which are necessary to create an active learning environment. The four components to active learning are equilibration, group activity, reinforcement and feedback, and application. Each of these components contributes directly to the learning environment. However, the most critical component is equilibration.

Equilibration is a mental process that, according to noted child psychologist Jean Piaget, contributes directly to the cognitive growth of individuals. Taking his cue from Piaget, Robert Karplus (1976), a leader in developing active learning models for science teaching, describes equilibration as "the internal mental process in which new experiences are combined with prior expectations and generate new logical operations" (p. 2). In order to initiate the process of equilibration, or self-regulation as it is sometimes referred to, a situation which provokes disequilibrium must be introduced. The presentation of a situation which requires students to draw on familiar experiences to solve a problem to which the solution may be unfamiliar is upsetting to their equilibrium. The mental discomfort of disequilibrium challenges students to think actively and constructively.

For example, in Oberman's (1983) active learning model designed for question analysis, students are asked to sort packets of questions into two piles and label those piles. The questions are benign so students are not puzzled over jargon. They must, however, determine the distinctions between questions (i.e., short or long; fact or research; objective or subjective). This is an exercise in disequilibrium. It is designed specifically so that students can draw on their familiar experiences with such questions, while forcing them to create and test hypotheses about how the questions should be categorized.[5] The result is that they are forced to think about the types of answers these questions require and the differences between these answers.

The purpose of disequilibration is to create a situation which demands active thinking on the part of students, active thinking which requires them to discover, on their own, a new pattern or new idea. This self-discovery, as is true with most "learning by doing" activities, has the added benefit, at its best, of students remembering what they discovered and transferring the principle to a new problem.

The creation of disequilibrium in a classroom, however, must be well managed. Nothing is more counterproductive than giving students an exercise which results in frustration and ends in despair. Thus it is critical to the success of any self-regulation exercise to ensure (and control) the level of frustration. One of the easiest ways to reduce anxiety among students when asking them to solve an unfamiliar problem is to have them work in groups. Group activity, the second key component to active learning, is a powerful technique in a learning environment.

The worth of group activity behavior in learning activities (Bouton & Garth, 1983) has been well documented. Four important advantages are consistently ascribed to group activity. First, in any group a natural leader emerges from within the group. This ensures that the group will perform the task at hand with minimum intervention from the teacher. Second, quicker learners in the group will assist slower learners. Peers are responsive to one another and demonstrate a patience in explaining problems and processes to one another. Third, students feel more comfortable in offering ideas, exchanging thoughts, and contributing to discussion in small groups. Interaction in small student groups is most often lively and free of the constraints of public exposure. Finally, group activity usually results in an increased interest in the learning activity at hand because it eliminates the potential for individual frustration.

Active learning, however, is not wholly dependent on group activity by students. Active learning requires the teacher, or leader, to assume the roles of manager, expert, consultant, and interpreter. These roles are best played by providing appropriate reinforcement and feedback to students at critical junctures in the active learning sequence. Reinforcement and feedback can take either an oral or written form. During group activity, the leader is actively engaged in visiting each group, listening, offering advice, answering questions, and even gently guiding groups in their discovery process. Again, this active role reduces the potential for frustration by making the leader available during the exploring and thinking process. Written reinforcement and feedback is also a powerful teaching tool. It allows the teacher, in the role of expert, to confirm the solution or solutions

to a disequilibrium activity in a positive and constructive manner. It also enables the expert to expand upon the solution of the problem through additional explanation or illustration.

Finally, the active learning model must incorporate an application stage. The application stage ensures that the discovery of a concept or skill through group activity can be generalized to a new problem. Application reinforces the concept being taught, while at the same time, it may involve further cognitive challenges. For instance, in the question analysis example, the sorting of cards into two distinct piles was a prelude to introducing the concept that different types of questions require different research approaches. The next step is taking one of the "research-like" questions and narrowing it by a set of criteria (time, place, interest groups, etc.). The exercise ends with an application that requires students to use what they have learned and apply it to a new and different question.

Active learning, then, is built on the assumption that critical thinking is, perhaps, even more important than subject content. In other words, if students can think critically about broad general principles, then they are more likely to be able to apply those principles to new and different problems. (For further information on the importance of critical thinking to education, see, Paul, 1990.)

Providing students with the cognitive tools to make informed decisions must become a keystone of library instruction. Students unable to cope with the overwhelming number of choices available to them will be further disenfranchised from the information structure. The allure of the online environment, whether in its singular CD-ROM format or its more complicated networks of databases, is powerful. Intelligent use of these new tools is essential to maximize efficiency and reduce frustration. Equally important is the emphasis that must be placed on the relationship of other information sources and their structures to the online environment.

The information world, particularly the electronic information world, is like a supermarket stocked with limitless varieties of resources. In this environment it is imperative that students face the choices on the "shelves" with the ability to discern which of the available products are appropriate. The alternative is that students, much like my friend facing the endless shelves of cereal, will turn and walk away.

Endnotes

1. Carol Kuhlthau is currently working on a study with Rutgers University students.
2. The author has conducted numerous instructional workshops on conceptual approaches and active learning for bibliographic instruction across the United States and Canada over the past ten years. The anecdotal evidence is drawn from hundreds of conversations from practitioners in the field.

3. According to Inhelder and Piaget (1958), there are four stages of cognitive development: sensorimotor, pre-operational, concrete, and formal (abstract). The earliest stages, sensorimotor and pre-operational, are cognitive growth stages which mature from infancy to age six. The concrete thinking stage, which is characterized by being able to use known experiences to solve problems through simple associations and step-by-step instruction, is complete by age eleven. By age thirteen, a concrete learner begins the transformation to a formal or abstract learner. The formal/abstract learner is able to think in theoretical terms, can reason with concepts, relationships, and abstractions, and can plan lengthy procedures given overall goals and resources. Studies, such as Tomlinson-Keasey (1975), refute Piaget's belief in a natural and inevitable development of cognitive development and suggest that most college students are not formal/abstract thinkers.
4. For examples of active learning models adapted for library instruction, see Oberman (1983) and Oberman and Linton (1982).
5. For a more detailed explanation of equilibration see Oberman (1983), pp. 24-25.

REFERENCES

Allen, G. (1990). Research notes: Database selection by patrons using CD-ROM. *College & Research Libraries, 51*(1), 69-75.

Association of College & Research Libraries. Bibliographic Instruction Task Force on Statement of Objectives. (1987). Model statement of objectives for academic bibliographic instruction: Draft revision. *College & Research Libraries News, 48*(5), 256-261.

Baker, B. (1986a). A conceptual framework for teaching online catalog use. *The Journal of Academic Librarianship, 12*(2), 90-96.

Baker, B. (1986b). A new direction for online catalog instruction. *Information Technology and Libraries, 5*(1), 35-41.

Baker, B., & Sandore, B. (1988). *Effective information retrieval: A model for teaching and learning.* Unpublished paper presented at the Library and Information Technology Second National Conference, Boston, October.

Beaubien, A. K.; Hogan, S. A.; & George, M. W. (1982). *Learning the library.* New York: R. R. Bowker.

Bloom, B. S. (Ed.). (1984). *Taxonomy of educational objectives: The classification of educational goals.* New York: Longman.

Bouton, C., & Garth, R. Y. (Eds.). (1983). *Learning in groups* (vol. 14 of the series *New directions in teaching and learning*). San Francisco, CA: Jossey-Bass.

Huston, M. M., & Oberman, C. (1989). Making communication: A theoretical framework for educating end-users of online bibliographic information retrieval systems. *The Reference Librarian, 24,* 199-211.

Inhelder, B., & Piaget, J. (1958). *The growth of logical thinking: From childhood to adolescence.* New York: Basic Books.

Karplus, R. (1976). *Science teaching and the development of reasoning.* San Francisco, CA: National Association for Research in Science Teaching. (ERIC Document Reproduction Service No. ED 123 128)

Keresztesi, M. (1982). The science of bibliography: Theoretical implications for bibliographic instruction. In C. Oberman & K. Strauch (Eds.), *Theories of bibliographic education: Designs for teaching* (pp. 1-26). New York: R. R. Bowker.

Kuhlthau, C. C. (1987). An emerging theory of library instruction. *School Library Media Quarterly, 16*(1), 23-28.

Kuhlthau, C. C. (1988). Developing a model of the library search process: Cognitive and affective aspects. *RQ, 28*(2), 232-242.

McInnis, R. (1982). Do metaphors make good sense in teaching research strategy? In C. Oberman & K. Strauch (Eds.), *Theories of bibliographic education: Designs for teaching* (pp. 47-74). New York: R. R. Bowker.

Mellon, C. A. (1986). Library anxiety: A grounded theory and its development. *College & Research Libraries, 47*(2), 160-165.

Momenee, G. (1987). Asking the right question: Why not InfoTrac? *Research Strategies, 5*(4), 186-190.

Oberman, C. (1983). Question analysis and the learning cycle. *Research Strategies, 1*(1), 22-30.

Oberman, C., & Linton, R. A. (1982). Guided design: Teaching library research as problem-solving. In C. Oberman & K. Strauch (Eds.), *Theories of bibliographic education: Designs for teaching* (pp. 111-34). New York: R. R. Bowker.

Oberman, C., & Strauch, K. (Eds.). (1982). *Theories of bibliographic education: Designs for teaching.* New York: R. R. Bowker.

Orwell, G. (1949). *1984.* New York: Harcourt Brace Jovanovich.

Paul, R. (1990). *Critical thinking: What every person needs to survive in a rapidly changing world.* Rohnert Park, CA: Center for Critical Thinking and Moral Critique, Sonoma State University.

Piaget, J. (1972). Intellectual evolution from adolescence to adulthood. *Human Development, 15*(1), 1-12.

Reichel, M., & Ramey, M. A. (Eds.). (1987). *Conceptual frameworks for bibliographic education: Theory into practice.* Littleton, CO: Libraries Unlimited.

Rudd, M. J., & Rudd, J. (1986). The impact of the information explosion on library users: Overload or opportunity? *The Journal of Academic Librarianship, 12*(5), 304-307.

Shaw, W. (1988). Technology and transformation in academic libraries. In P. S. Breivik & R. Wedgeworth (Eds.), *Libraries and the search for academic excellence* (pp. 137-44). Metuchen, NJ: Scarecrow Press.

Shill, H. B. (1987). Bibliographic instruction: Planning for the electronic information environment. *College & Research Libraries, 48*(5), 433-453.

Smith, E. (1990). *The librarian, the scholar, and the future of the research library.* New York: Greenwood Press.

Tomlinson-Keasey, C. (1975). *A search for the component operations of formal operations.* Unpublished paper presented at the Society for Research in Child Development Convention, Denver, Colorado.

Wiberley, S. E., Jr., & Daugherty, R. A. (1988). Users' persistence in scanning lists of references. *College & Research Libraries, 49*(2), 149-156.

Williams, L. (1990). Free choice: When too much is too much. *New York Times,* pp. C1, C10.

York, C. C.; Sabol, L.; Gratch, B.; & Pursel, J. (1988). Computerized reference sources: One-stop shopping or part of a search strategy? *Research Strategies, 6*(1), 8-17.