Discipline-Based Information Literacy and the Lifelong Learner

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Introduction

Graduating information literate students is rapidly becoming part of the mission of higher education institutions (Association of College and Research Libraries [ACRL], 2000) and is growing in importance as the amount of information readily accessible by multiple means of access increases. The relationship between information literacy and lifelong learning is well documented in the literature (ACRL, 1989, 2000; Breivik & Gee, 1989; Bruce, 1997; Candy, Crebert & O'Leary, 1994; McCartin & Feid, 2001). The issue that both librarians and academic course faculty struggle with is how best to teach information literacy to enable lifelong learning. This paper will examine some of the various ways information literacy is taught and propose a new model of teaching information literacy to ensure lifelong learning. Our model is based on the development of an internalized schema of information and information sources learned within the context of a specific discipline but providing a framework that is transferable to other disciplines as well as business, professional and everyday situations.

Lifelong learning has been defined as "the systematic acquisition, renewal, upgrading and completion of knowledge, skills and attitudes made necessary by the constantly changing conditions in which people now live." (Candy et al., 1994). These constantly changing conditions have contributed to the emergence of what some have referred to as an "information society" (e.g., Schrock, 1999). How is information literacy directly related to living in such a society? According to the report issued by the Association of College and Research Libraries (1989) entitled Presidential Committee on Information Literacy: Final Report:

> How our country deals with the realities of the Information Age will have enormous impact on our democratic way of life and on our nation's ability to compete internationally. Within America's information society, there also exists the potential of addressing many long-standing social and economic inequities. To reap such benefits, people---as individuals and as a nation---must be information literate. To be information literate, a person must be able to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information. Producing such a citizenry will require that schools and colleges appreciate and integrate the concept of information literacy into their learning programs and that they play a leadership role in equipping individuals and institutions to take advantage of the opportunities inherent within the information society. Ultimately, information literate people are those who have learned how to learn. They know how to learn because they know how knowledge is organized, how to find information, and how to use information in such a way that others can learn from them. They are people prepared for lifelong learning, because they can always find the information needed for any task or decision at hand (p.1).

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Since that time, the information age has been characterized by the rapid growth of new information readily available in multiple formats. The widespread use of the web, as well as remote access and 24-hour access (sans a librarian) among students and the public has led to the "do-it-yourself" nature of information seeking and gathering. The mass availability of information via the web brought the critical issues of learning to access, evaluate and effectively use information to the forefront. One of the efforts that has been made in the educational community to establish authority over information has been to promote the use databases which, like published print products, have some inclusion and exclusion criteria. Getting students to use databases rather than the web, and to be able to discriminate between the two, has been a major undertaking. But another problem arises: databases change, their interfaces change. Information that is available in one format on one database may be available in another format/database or even freely available on the web. Thus, teaching the use of databases in itself does not seem to be an appropriate solution. This is particularly true for the lifelong learner, who may not be searching for and utilizing particular types of information on a regular and frequent basis.

Recent years have seen an emergence of learning themes that emphasize the learner, including the concept of lifelong learning. Information Technology (IT) is supposed to enable this type of learning to occur (Todd, 1998). Lin (2000) also describes the need to become fluent with information technology so lifelong learning can occur. Yet quality learning will occur only through the application of information technologies, not their mere existence. It is the conceptualization of the information which is made more readily available through IT that will enable learners, not knowledge of the IT itself. Such knowledge becomes passé in a very short time, a major issue when one is thinking in terms of promoting lifelong learning.

Preparation for lifelong learning involves equipping students with a framework for 'learning how to learn" using their intellectual capabilities for reasoning and critical thinking. (ACRL, 2000, p.4). This framework for learning is information literacy, which extends beyond the classroom and the library and provides students with the means to become self-directed learners. It is based on identifying information needs based on the problem at hand, finding, understanding, evaluating and using information resources and integrating that information into one's own knowledge base, the core of information literacy. This conceptual model is applicable to all disciplines and becomes a permanent fixture within the student's knowledge base, providing a basis for learning that will benefit the student both personally and professionally. The information-literate student possesses the tools for identifying, obtaining and applying relevant and valid information in varied formats and media and becomes a self-directed learner and critical thinker who can ask informed questions and is aware of bias, misinformation, and misuse of information. Information literacy is "now considered a key outcome by several higher education accrediting associations in the United States; Middle States Commission on Higher Education (MSCHE), Western Association of Schools and Colleges (WASC) and the Southern Association of Colleges and Schools (SACS)" (ACRL, 2000, p. 4)

Despite such consensus about the importance of information literacy, there is a good deal of evidence that users cannot select appropriate materials, do not understand either how information is organized (structure of information) or the

value of different sources of information, and cannot critically evaluate information (e.g., Allen, 1990; Bodi, 1995; Kunkel, Weaver & Cook, 1996; Nash & Wilson, 1991; Reed, 1993; Wallace 1993).

Models of Information Literacy Instruction

As mentioned earlier, we have become a society of "do-it-yourself" information seekers and gatherers, largely in response to the availability of information on the web, remote access and 24-hour access. In the past, information specialists such as librarians served as gatekeepers, providing access to credible information. Recently, however, the librarian's role has increasingly shifted from the gatekeeper role to the teaching role.

Historically, most academic library instruction consisted of single-class or "one-shot" bibliographic instruction courses that are still taught today. "One-shots" commonly refer to when a faculty member brings his or her students to the library during one (occasionally two) of their approximately thirty sessions within a semester. One type of session simply may consist of a library orientation; a second, more common form today, is a session geared to a specific course assignment. Students typically already have a research project assigned. The class usually consists of a brief overview of what types of resources are useful and appropriate for the assignment; the librarian may bring print materials such as specialized encyclopedias and will demonstrate the use of appropriate electronic resources. This is sometimes followed by a hands-on period (within the same class period) wherein students have the opportunity to use the resources with the assistance and supervision of the librarian and course faculty member.

As the complexity of information expanded, librarians realized that one-shot bibliographic instruction courses were not addressing the goals of information literacy (Zhang, 2001). Many libraries at higher education institutions began to offer generic library courses. Courses vary across institutions as to length of course, credits earned, graded or pass/fail, required/not required and/or "test-out." The objective of these courses is to provide the student with information literacy skills that apply across disciplines. Generally, these courses teach how knowledge is organized in both print and electronic formats, principles of database searching (e.g. boolean logic, field searching, subject searching, etc), evaluation strategies, characteristics of scholarly literature, and the nature of the web.

Another method of teaching information literacy is to embed a generic library course into a freshmen or first-year experience. Some institutions have responded to dismal retention rates by instituting programs to help first-year students deal with the pressures of college life. These new students learn how to manage time and social pressures and improve their study skills. Learning communities, freshmen seminars, and cohort groups are some of the models that are being implemented in higher educational institutions. Librarians have sought to become involved with the first-year experience in the hope that reaching students early in their academic career and enabling them to become information literate early on will benefit them throughout the college experience.

Within these frameworks, some institutions have designed online workbook/ tutorials that allow students to learn information skills at their own pace. There are various ways this method is used. Workbooks/tutorials may be required as part of a freshmen core requirement or they may be used as a substitute for a generic

library course. The purpose of a workbook/tutorial is to introduce students to basic library skills. It may be general or discipline specific and usually includes assignments and quizzes. Skills learned from this method can be reinforced with related projects assigned by course faculty.

Limitations of "One-Shots," Generic Courses, and Freshmen Experience Components

While the one-shot model has a definite value, there are several limitations from a broad information-literacy perspective. One is that the students learn a narrow range of resources for a particular type of assignment. As noted by Tierney (1992, p.65), the courses do not allow for "systematic, sequential preparation for advanced research in their field." A second problem is that because students are highly motivated by grades (e.g., Valentine, 2001; Nerz & Weiner 2001), they sometimes only value what is going on in terms of their grade on that particular assignment and do not have any concept of having increased their knowledge of their discipline. The limited time period reinforces the above issue in that the class needs to be "task-oriented" to the assignment rather than conceptually-oriented to the research process. This illustrates the need for close collaboration between librarians and teaching faculty when attempting to integrate information literacy into the curriculum by designing research projects. Although the result of "one-shot" courses can be improved research assignments, the very specific skills learned are usually not transferred to other areas.

Responses offered through generic library courses and freshmen experiences also have some limitations. Often students take such courses because the course or program is required or the student needs an extra credit to maintain full-time status or to graduate. As a result, students don't attach any relevancy to these courses. In our experience, students just want to know "what do I have to do and how do I do it". The educational experience becomes product not process oriented. Skills do not transfer because there is no context in which meaningful concepts of information and information sources are internalized. In addition, some have questioned whether such instruction during the first semester may be premature, as introductory courses such as those taken then often do not require materials outside of the textbook.

Finally, regarding workbooks/tutorials, studies have shown that learning was marginal when using workbooks alone. Although students reacted positively to the workbooks when surveyed, reference librarians found that skills learned were not transferable to actual projects. (Tierney, 1992; Ware & Morganti, 1986). Once again, while students were successful with the workbook assignment (i.e. the task), it appears there was no conceptual learning available to be transferred to other assignments.

Discipline-Based Information Literacy

The limitations reviewed above have led a number of authors to promote discipline-based information literacy. As far back as the 1950's, Knapp (1958) stressed the importance of librarians directing their efforts to the curriculum and working with other faculty. More recently, others have supported team-taught courses by librarians and course faculty (e.g., Winner, 1998). Beyond that, Stoffle

and Williams (1995) have stated that "The new academic library will be a teaching library." If this is the case, and anecdotally, it does appear to be so, then how will this work?

A number of authors have argued that librarians are uniquely qualified to take an active role in information literacy as they have traditionally been the experts in collecting, organizing, evaluating, and providing access points to information (e.g., Rader, 1997).

In addition, numerous studies have stressed the importance of the faculty-librarian partnership in furthering information-literacy programs (e.g., Amstutz & Whitson 1997; Bruce, 2001; Dennis, 2001; Dupuis, 1997; Higgins & Face, 1998; Iannuzzi, 1998; Leckie & Fullerton, 1999; Maynard, 1990; Nerz and Weiner 2001). Yet many of these studies also indicate that how this happens is often vague and confusing.

For example, Maynard (1990) points out that department faculty have both variable and inconsistent attitudes toward library instruction. Hardesty (1991, 1995) found that this is often because those faculty do not themselves have a clear idea of the complexity of information available through their library services. Leckie and Fullerton (1999) note that although both groups want to provide a quality education and skills for lifelong learning, there is confusion about who is responsible for information literacy in a discipline. Numerous other studies (e.g., Divay, Ducas & Michaud-Oystryk, 1987; Lipow, 1992; Ivey, 1994; Major, 1993) have found that librarians and department faculty do not have a clear idea of each others' roles or expectations.

Given all this confusion, we come back to the question of "if the library of the future is a teaching library, what will that look like?"

In a study of department faculty perceptions of library instruction, Cannon (1994) found that the majority preferred a shared approach (with library faculty) to teaching information-related skills. Such discipline-based information literacy presumes a certain amount of knowledge of a particular discipline(s) on the part of the library faculty, which may lead to better understanding between the parties. There has been a recent move to subject specialization among librarians which can take many forms, but is based on some type of expertise, either through formal graduate education in a discipline, or through informal learning of a discipline.

Grafstein (2002) also points out that information literacy is a shared responsibility among librarians, administrators and teaching faculty. As mentioned earlier, librarians are in a unique position to impart searching skills and critical thinking skills when evaluating information (e.g. timeliness, authority, bias, verifiability, logical consistency) while teaching faculty can guide students in evaluating the content of information sources and integrating it into the students knowledge base within the structure of the discipline. In the case of the subject specialist librarian, the librarian may teach more of the content in terms of the discipline, whereas the course faculty will be more involved in the content in terms of the particular course and assignment.

At Hofstra University, we practice subject specialization and offer a generic, optional, credit-bearing undergraduate information literacy course. We also offer a variety of one-shot sessions, as well as 6-12 hour programs (spread over several sessions) for several disciplines, and mostly for graduate students, with some exceptions. While much current thinking on information is based on adult learning theory, and acknowledges that information literacy is best achieved if it is

curriculum-driven and occurs at a point of informational need (Leckie & Fullerton, 1999), our experiences have led us to favor a higher-order, discipline-based approach to information literacy that students will be able to use throughout their lifetimes. We believe this occurs best not as a means to meet a specific, immediate informational need, but rather as part of a discipline's curriculum. We also believe that this can occur in a number of ways, including team-teaching in undergraduate or graduate seminars or through an adjunctive required program for graduate students.

A number of reasons favor embedding information literacy into the curriculum. One reason is that the discipline is one that the student has chosen, and therefore theoretically one in which the student has some investment. A variety of studies have been done on cognitive processes involved in learning, particularly affect and motivation as well as interest and prior knowledge (for a review of such studies, see Tobias, 1994). Although there are some contradictory results, generally speaking there is a positive linear relationship between such factors and learning (Tobias, 1994).

Another reason for embedding is based on learning studies. Renninger (1992) found that people work harder and learn more on tasks of interest than those of less interest, and that people engage in deeper comprehension processes on topics of interest to them. Also, embedding information into their major enhances the probability that students will see the real-world utility of having an understanding of the universe of information in their field.

As an example, a survey of chemical engineers found that they currently spend considerable time retrieving and using information on topics such as management, regulatory requirements, economic forecasts, and research methodologies (Rosenzweig & Gardner 1994). Yet, respondents in the survey depended on their personal collections and colleagues for information, and more than half attributed this to their difficulty in finding and using information appropriate to their needs. Geoscientists seem to experience similar issues (Bichteler & Ward, 1989). These cases illustrate that even professionals have difficulty organizing knowledge of information and relevant sources. Pinelli, Barclay, and Kennedy (1995) also assert that entry level engineers do not have the information literacy skills necessary for a successful engineering career.

As most students go from undergraduate education directly into careers, they would clearly benefit from an internal knowledge structure of their field that they can carry with them into their careers. In a similar vein, the Boyer Commission noted "For those who do not enter graduate school, the abilities to identify, analyze, and resolve problems will prove to be invaluable in professional life and citizenship." (Boyer Commission, 1998, p. 17)

Another reason to embed information literacy within a discipline's curriculum is that several studies have found that students are highly motivated by grades (e.g., Valentine 2001; Nerz & Weiner 2001). Thus, placing literacy requirements in the context of grading enhances their value in the students' eyes, raising them to a level above merely a means to an end.

Schema-Oriented Discipline-Based Information Literacy

In a review of information literacy trends, Rader (2000) notes that academic libraries have moved from library orientation to library instruction to course-

integrated instruction to information skills instruction. We would argue that we should be moving beyond information skills instruction and into fostering a higher order conceptual model.

As an example, Brown and Krumholz (2002) found that although students participating in a 2-session instructional science information literacy program improved on the content of their presentations, critiques, and questions, they were still unable to "think out of the box" (p. 119). They still did not extend their thinking to a higher level of abstraction. One reason for this may be Curl's (2001) observation that even academic librarians tend to restrict their information literacy efforts to scholarly literature such as refereed journals, but that the importance of professional, technical, trade papers and other materials should not be neglected. This caveat is probably especially important when one thinks in terms of lifelong learning as opposed to curriculum-fulfilling tasks.

The adoption of such a higher-order model may, in fact, be a partial answer to the issues mentioned earlier, such as department faculty not having a clear concept of the complexity of information and information sources for their field (Hardesty 1991, 1995), confusion about who (department faculty or librarians) is responsible for information literacy within a discipline (Leckie & Fullerton, 1999), how department faculty and librarians might best share the teaching of information-related skills (Cannon, 1994), and the confusion of roles and expectations between department faculty and librarians (Divay et al., 1987; Ivey 1994; Lipow, 1992; Major 1993).

In an article entitled "Paradigms of Knowledge and Instruction," Farnham-Diggory (1994) articulates five types of knowledge that may be acquired:

1. Declarative knowledge - factual information that may be declared
2. Procedural knowledge - knowledge of action sequences that can be demonstrated
3. Analogical knowledge -- can be related to previous experience (current situation B is similar to previous situation A
4. Conceptual knowledge - consisting of categorical knowledge and schemata
   A. Categorical knowledge -- categories are defined by a list of attributes (e.g., encyclopedias have indexes, and are arranged alphabetically or geographically etc, websites have links, databases have fields)
   B. Schemata--include categorical knowledge, but also have a spatial (i.e. map-like) and/or temporal (i.e. script-like) qualities, placing them at a higher level
5. Logical knowledge - a mental model of what's related to what and what leads to what, based on experiential reasoning

The model that we would suggest incorporates each of these types of knowledge, but is built at the higher order of the creation of a conceptual schema of information and information sources. Although first learned (and we believe best-learned) within a particular discipline, the schema can be generalized and thus useful in the lifelong learning that is required for an individual to do anything more than survive in today's world.

As Farnham-Diggory indicates, schemata also have spatial and/or temporal qualities. Several studies (e.g., Long, Winograd, & Bridge, 1989) have found the use of mental imagery increases on tasks of interest, and other studies have found that use of visual imagery is associated with increased comprehension (Anderson

& Kulhavy 1972; Levin 1981, Schiefele, 1991, 1992). Curiosity is another factor that has been studied, and has the advantage of having several measures that can be used (Tobias, 1994). Many of the studies on learning make distinctions between interest and prior knowledge and situational interest and topic or individual interest (Krapp, Hidi, & Renninger, 1992). Situational interest is aroused by a situation (e.g., novelty, problem-solving) and is characterized as relatively transient. Topic or individual interest is a relatively enduring interest in particular topics or tasks.

For our purposes, these distinctions are irrelevant. For the lifelong learner, sometimes the motivation may be situational (e.g., an employment, educational, or zoning issue which creates an informational need) and at other times it will be more individual or topical (a chronic medical condition, hobby, desire to keep current on a topic of interest).

Alba and Hasher (1983) define a 'scheme" as a knowledge structure for organizing associated concepts that is based on prior experience. In an article on source monitoring, which involves judgments about the source of information, Bayen, Nakamura, Dupuis, and Lang (2000) note that numerous studies suggest that people rely on previous knowledge to make determinations about sources of information. Source monitoring actually involves having information and determining where it originated based on plausibility and prior experience. Our question is one in which the individual does not have the information, but must determine what is a likely source. Moreover, Bayen et al. (2000) note that there is a semantic, or meaningful relationship between information sources and the content of the information. This finding supports the rationale for developing a schema within a discipline, which in turn facilitates students' learning that information is produced for a variety of reasons which influence the information made available to users (i.e., within a discipline, who are the stakeholders, what is their mission, how does it influence the information produced).

So, what would be the components of a generic model of information that would serve an individual's lifelong information needs? How would it be taught? How would the student and lifelong learner use it?

What is important in our model is that the user develops an internalized schema of information. This model is learned in the context of their discipline. One might think of this educational process as a "fill in the blanks" process. The structure of the problem is there, and one needs to fill in the information for the topic at hand, either in school, at work, or in one's personal life. The student also learns the relationships among the information sources (e.g., specialized encyclopedia and handbook articles often have a reference list of major related journal articles and books). The model encompasses different types of literature, including popular, trade, scholarly, and advocacy literature, general sources such as dictionaries, encyclopedias and handbooks, books, government publications at the federal, state, and local levels, audio-visual materials, websites, and databases. The information literate student knows that who publishes the information is important, and so is aware of their agenda. For instance, governments, academic and research institutions, advocacy groups and commercial enterprises all produce information for a variety of reasons. Students also know effective search methods; if they are looking for something specific, browsing is neither effective, exhaustive, nor efficient, and that they need to use a guide such as an index, abstract, or bibliography, whether print or electronic.

The second question is how does one teach information literacy in such a way that it becomes internalized as a schema and thus transferable to lifelong learning. In a chapter entitled "Learning from schema-based instruction," Marshall (1995) describes several studies in which students were exposed to specific instruction, abstract instruction, or both types of instruction.

These variables were selected because they are analogous to common classroom teaching methods of giving definitions and examples. The studies demonstrated that when questioned later, students who were given abstract instruction tended to generate their own examples (elaboration) and that students given example-specific instruction tended to generate their own abstract concepts. Over time, abstract-instruction students were increasingly able to elaborate examples, and example-specific students were able to provide higher-level abstract conceptualizations of their learning; the latter's performance, however, improved more slowly than the former, which may support the hypothesis that schemas take time to develop. Students who received both types of instruction performed significantly better than either of the other groups.

Marshall's studies also provide support and guidelines for incorporating information literacy schema into students knowledge base. Interestingly, the first specific example provided to any concept was the most frequently remembered by all groups. Thus, one would want to provide a generalized description of a resource type (e.g., typical organization, information included, depth of information, audience, source), followed at first by the best prototypical example within that discipline. Marshall also found that students in each of the groups demonstrated confusions in mapping specific examples to abstract concepts. Abstract-instruction students had more confusions; however, the two groups differed in type of confusions. Abstract-instruction students tended to attach examples to the wrong abstractions, whereas specific-example instruction students tended to be unable to attach the examples to any abstraction. Thus, in addition to providing prototypical first examples followed by other examples within each type of resource (each resource being different but related), it would follow that one should demonstrate differences among the examples, i.e., why example A falls into one category and not another category. As selection of type of resource is a key component of information literacy, one would also focus not only on differences between categories of materials, but on how differences in the user's information needs are related to the type of resource selected. Finally, in addition to elaborating such differences in needs and resources, one would emphasize the relationship of resources; understanding such relationships is an important component of developing schemata.

A useful way of thinking about the lifelong learner and for conceptualizing information resources might be that developed by Voight (1961). In describing how scientists and engineers approach information, he identified three manners of approach. The 'everyday approach" is a straightforward need for factual information. As applied to our model, students would be able to consult general information sources (e.g. specialized encyclopedias, directories, dictionaries). The "current approach" is when the user wants to keep current on information on a particular topic; here our student knows which sources provide current data (print and electronic literature, electronic alerts). The "exhaustive approach" is when the user wants to exhaust all information on the topic. The information literate student is aware of the variety of sources (e.g. general information, print and electronic

periodical literature) that would need to be consulted, evaluated and integrated in order to "exhaust" a topic.

The mental model we are proposing is one which would facilitate movement from what Subramanyam (1981) refers to as the idea generation stage to the information utilization stage. One of the first steps for the user would be to establish which of Voight's approach modes he or she is in. After recognition of the information need, the user could then refer to the schema that they had internalized. And what would this schema look like? See Figure 1 for a schema of what a generic universe of information might look like, as well as criteria by which users would select and evaluate the information.

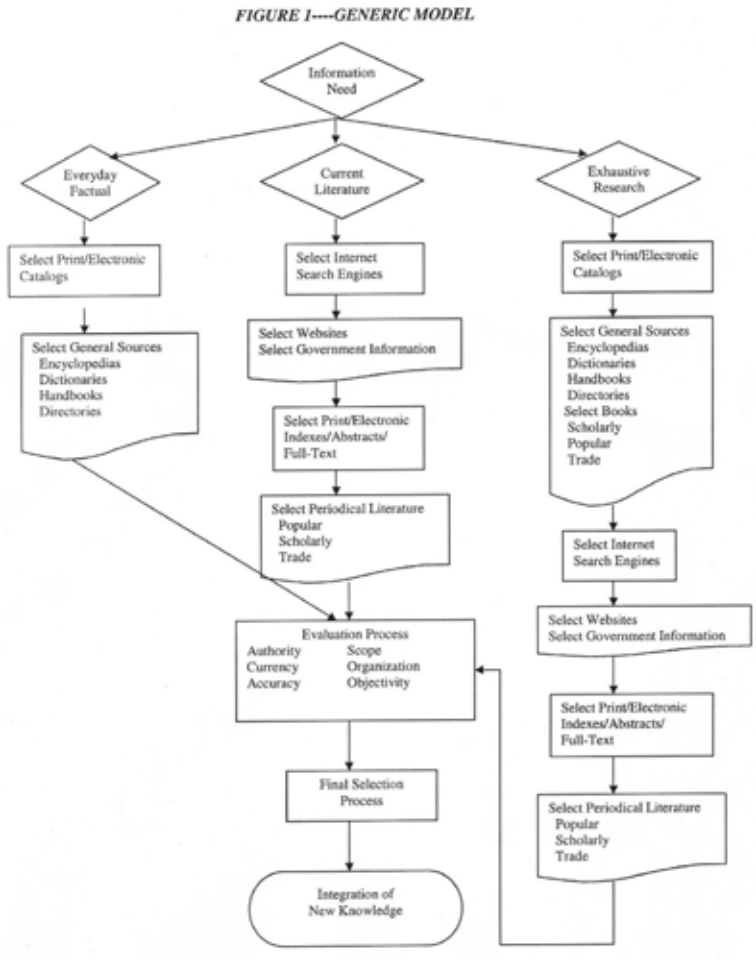

Figure1
Generic Information Literacy Schema

Examples of Transferability

Our model enables students to acquire information literacy skills that can be transferred to common situations. Figure 2 illustrates the transferability of a generic model into the need for medical, specifically cancer, information. We selected medicine as an example of transferability because it is an area in which virtually all individuals will have an information need for themselves or a family

member. As in the original model, there are sources that would be of interest primarily to the practitioner and others of interest primarily to the lay person, and we would expect the average information-literate person to know that there are specialized dictionaries, encyclopedias, and handbooks, with increasing information in each covering such topics as basic terms, illnesses, tests, and treatments. The average person should also know that there are directories of physicians that they can consult, that they may be arranged by geography, specialty, or both, with credentials, etc., and that the same is true for hospitals, treatment centers, etc.

He or she should know that there are organizations and associations representing professionals, providing professional advocacy, patient organizations, organizations for family members, patient advocacy organizations, fundraising organizations, etc, and that these organizations and associations are organized in print and electronic resources.

He or she should be aware that there may be existing or pending legislation on their issue of interest. And they should know that there is information on education and credentials of various allied medical professionals and continuing education requirements.

He or she should also know that, in this case of requiring medical information, they should be looking at the most current materials available and be aware that there are criteria for inclusion or exclusion, and that those criteria should be indicated somewhere in the volume or website.

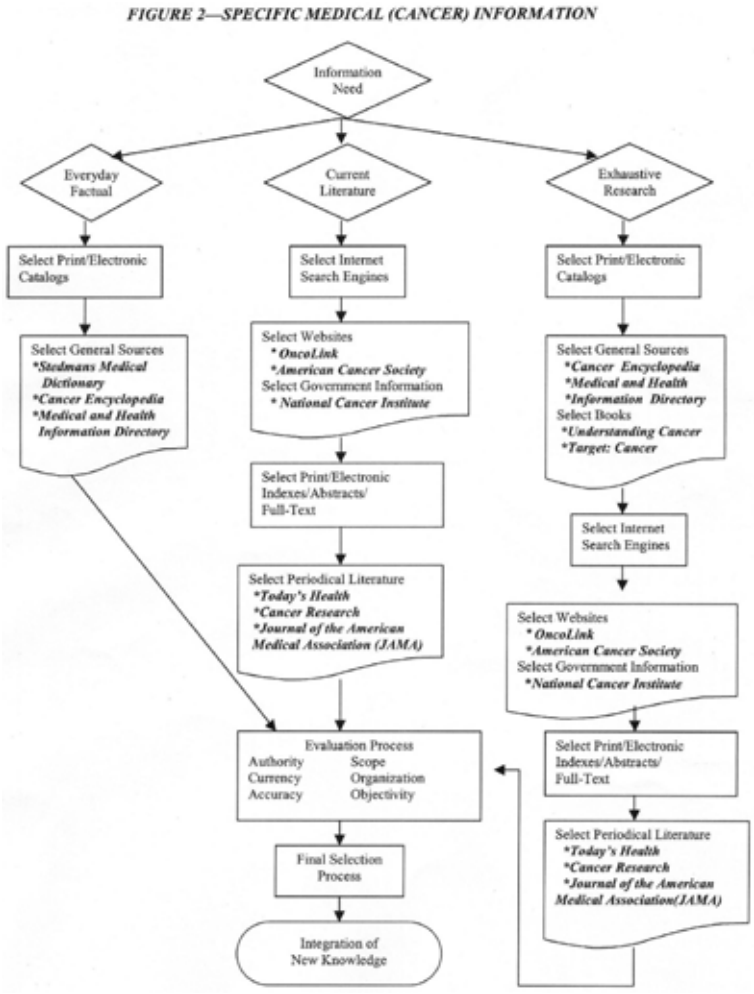

Figure 2
Specific Medical Literacy Schema

Conclusion

If a preferred method of becoming information literate is to develop a higher order model or schema of information and information sources by embedding such learning within a discipline, how does this happen? Although Tierney (1992, p. 66) states that students "acquire knowledge of the content of their disciplines in a cumulative manner, through a sequence of courses, the process of learning the literature of a discipline logically follows a similar pattern, one layer at a time…….the path to information literacy should parallel as well as interconnect with the path to undergraduate mastery of discipline content," in reality this does not take into account those students who transfer into a program or due to scheduling issues, do not follow a linear sequence of courses. Implementation of a discipline-based information literacy program requires the commitment not only of individual course faculty and librarians, but of administrators such as department chairs and deans to ensure that every student graduates information literate. As Grafstein (2002) notes, information literacy programs are most successful when

strategies are developed within the philosophy of academic administrations-information literacy should be part of the academic mandate of the institution.

The role of the university in educating a student is to provide opportunities for inquiry rather than the mere transmission of knowledge. Courses should be structured so students can discover and communicate knowledge as well as identify, analyze and resolve problems. It is the students' responsibility to understand that a university education is not solely a means to an end, but rather is a means to become an educated person. The processes and efforts that are involved in becoming educated are analogous to those necessary for success in other endeavors such as work, graduate school and life in general.

There are, of course, differences in the structure and research methodologies of disciplines. It is worth noting, however, that Curl (2001) concludes her article by observing that while the resources mentioned in Subramanyan's 1981 article quickly became dated, his model of information literacy is still useful. Broad models such as we have proposed necessarily oversimplify the process; although formats change, the basic structure of the information model laid out in Figure 1 was applicable ten years ago and will be applicable ten years hence. The model is a heuristic, a "rule of thumb," rather than an algorithm. The model will be appropriate for today's twenty-two year old graduate when, as in our example, he or she is thirty-five years of age and seeking information on medical questions, employment questions, consumer information, parenting information, etc. That student has thus become a lifelong learner.

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