I-LEARN:
A Model for Creating Knowledge in the Information Age

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*The **I-LEARN** model—**I**dentify, **L**ocate, **E**valuate, **A**pply, **R**eflect, k**N**ow—both describes the process of learning with information and provides a learning sequence that can be taught. Grounded in research and theory from information science and instructional design, it is also based on the author's own research and writing. The model reflects an inquiry approach built on the three-part information-literacy paradigm that underlies many instructional activities in library media centers: accessing, evaluating, and using information. It expands that paradigm to focus specifically on the use of information as a tool for learning. Plans to validate the model in a digital library and in face-to-face environments are currently underway.*

Keywords: information and learning, inquiry learning, information literacy, validation

The I-LEARN Model

To be efficient and effective learners in the information age, students and others must be able to access, evaluate, and use various kinds of information, presented in a variety of formats, for a variety of purposes. Living in a world in which information flows freely and defies the boundaries of traditional disciplines and subject areas, young learners in particular must develop strategies for engaging with ideas that transcend the curriculum and its usual topics and structures. Simply put, to flourish in information environments that are rich and complex, students must learn how to use all kinds of information as tools for learning.

This paper describes a model for learning in today's (and tomorrow's) information-rich environments, outlines the model's theoretical and research background, suggests its implications and importance for both theory and practice, and lays out a plan for validating it. Based on research and theory from the broad fields of information science and instructional systems design, this theoretical model also reflects the realities of practice through its grounding in the author's series of observational studies of the information behavior of children and youth. Validating it—the next step in its development—will establish its practical utility in various learning environments.

Categories and Elements

The **I-LEARN** model includes six major activities that describe the overall process of learning with information. It also includes eighteen elements, three related to each category, that flesh out those major activities with suggested ways to implement them. It is anticipated that, in practice, the number of these elements might increase or decrease according to the needs of students and teachers and the demands of particular learning tasks.

Definitions for the categories and explanations of the elements follow:

Identify	***Choose a problem or question that can be addressed through information***
Activate	A sense of curiosity about the world
Scan	The environment for a suitable topic within that world to investigate
Formulate	A problem or question about that topic that can be addressed with information

Locate	***Access information, either recorded or in the environment***
Focus	On what is to be learned
Find	The information needed for that learning
Extract	The most relevant and salient information for that learning

Evaluate	***Judge the quality and relevance of the information found***
Authenticity	Credibility of source and/or author; internal logic; accuracy
Relevance	Topic at hand, level of learning/ depth required, appropriateness
Timeliness	Currency, accessibility

Apply	***Use the information for a learning task***
Generate	Construct new understanding, personal meaning
Organize	Determine appropriate cognitive structure (e.g., chronological, hierarchical, etc.)
Communicate	Create appropriate representation to convey that structure

Reflect	***Examine product and process***
Analyze	Adequacy of both form and content
Revise	Improve as necessary
Finalize	Polish as appropriate

kNow	***Instantiate knowledge gained***
Personalize	Recognize meaning as personal construct
Internalize	Integrate with previous knowledge
Activate	Draw upon as necessary and/or appropriate

It is significant that the "**I**" in the initial category suggests several concepts in addition to "**I**dentify": the dependence on **I**nformation as the building block for learning is clearly implied, as is the personal responsibility for one's own learning assumed by constructivism ("**I**" create my own understanding of the world). Further, it is important to note that the "k**N**ow" category ends with the element entitled "activate"—the same element that begins the learning process under "**I**dentify." The implication is that greater knowledge about the world is likely to stimulate even more curiosity about its nature, structures, and processes.

Theoretical Framework

The closest ancestor of **I-LEARN** is *Information Power: Building Partnerships for Learning* (1998)—the national guidelines for the school library media field jointly developed by the American Association of School Librarians and the Association for Educational Communications and Technology. The guidelines themselves are grounded in previous research, beginning with Doyle's (1992) early work to identify the components of information literacy, and assume the American Library Association's definition of information literacy:

> 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. . . . Ultimately, information literate people are those who have learned how to learn. . . . They are people prepared for lifelong learning because they can always find the information needed for any task or decision at hand. (*ALA Presidential Committee Report*, p. 1, quoted in Behrens, 1994, p. 315).

This definition is significant because it makes explicit the link between learning and information use. It suggests going beyond the general notion of information seeking—that is, accessing and evaluating information—to encompass the ultimate reason for students' information seeking—that is, learning. The key assumption underlying the model is that "developing expertise in accessing, evaluating, and using information is in fact the authentic learning that modern education seeks to promote" (AASL & AECT, 1998, p. 2).

Theoretically, the **I-LEARN** model is closely related to the three-part information literacy paradigm that suffuses *Information Power* and that underlies many of today's instructional activities in college and university libraries and in K-12 library media centers: *accessing* information, *evaluating* it, and *using* it to answer a particular question or to complete a particular assignment. "**L**ocate" is obviously related to "access," although the model encompasses locating information inherent in the environment as well as accessing information in databases and other library resources. "**E**valuate" is the same concept in the model as it is in the usual conception of information literacy. The model's chief contribution lies in its expansion of the dimension of "Use": its three culminating categories greatly extend the information-literacy idea of "use" by tying it

directly to "learning." In typical models of information behavior, "use" is generally a vague term describing something beyond the information-seeking process itself. In the **I-LEARN** model, however, "use" is central: "**A**pply" describes the process of using information to generate knowledge—that is, to learn; "**R**eflect" is seen as a key factor in ensuring that learning is personally meaningful; and "k**N**ow" describes how individuals employ and expand their knowledge once learning has been accomplished.

The model links information behavior directly to learning—not only in a general way but, specifically, to the four types of knowledge and six levels of learning described in Anderson & Krathwohl's (2001) revision of Bloom's *Taxonomy of Educational Objectives*. These relationships are dynamic and malleable rather than predictably one-to-one, but the links are intriguing: "**L**ocating" information involves finding *factual and conceptual knowledge* that will be the building blocks of learning; "**E**valuating" information involves using *metacognitive knowledge* to judge the appropriateness of information; and "**A**pplying," "**R**eflecting," and "k**N**owing" all involve both *procedural and metacognitive knowledge*. Even more intriguing is the relationship of the model to the taxonomy's levels of learning: "**L**ocate" is clearly tied to the levels of *remembering* and *understanding*; "**E**valuate" encompasses those levels and also suggests the levels of *analyzing* and *evaluating*; and "**A**pplying," "**R**eflecting," and "k**N**owing" involve those four levels and add the final two—*apply* and *create*. This overall relationship of the model to Anderson & Krathwohl's (2001) work reflects the dynamism inherent in both learning and information seeking itself.

The **I-LEARN** model also draws upon conceptions of the nature of information presented both in the information science literature (e.g., Buckland, 1991; Marchionini, 1995; Wilson, 1981, 1999) and in the literature of instructional design (e.g., Gagne, 1965, 1977, 1985; Hill & Hannafin, 2001; Mayer, 1999; Merrill, 1983, 1999). It assumes that information is itself a dynamic phenomenon consisting of entities and relationships that can be mixed and matched according to their nature and the uses to which they are put. In addition to incorporating the types of knowledge and the levels of learning outlined in Anderson and Krathwohl's 2001 revision of Bloom's *Taxonomy of Educational Objectives*, it is grounded in the understanding of learning summarized in Bransford *et al*. (2000). These authors' constructivist view of learning as an active, dynamic process that involves stages and levels meshes well with the dynamism of information itself. The **I-LEARN** model—itself a dynamic construct—encompasses all these dimensions.

The research base for the model stems primarily from its creator's research and writing for almost two decades (Neuman, 1993, 1995, 1997, 2003, 2004; Chung & Neuman, 2007). A consistent theme throughout these publications involves the ways in which information can be organized and presented to enhance students' opportunities for deep engagement with content that will enable them to construct higher-level knowledge. Ideas from many other researchers—Bilal, 2000, 2001; Crane & Markowitz, 1994; Eisenberg & Small, 1995; Fidel et al., 1999; Kafai & Bates, 1997; Kuhlthau, 1997; Large *et al*., 1994, 1995, 1996; McGregor, 1994; and Pitts, 1994; to name a few—have also informed the development of the model.

Implications

The model supports higher-level learning in the information age, both theoretically and practically. Theoretically, **I-LEARN** is grounded in contemporary notions of both learning theory and information theory and builds on both bases to suggest a new theory—a way to conceptualize learning in an age that requires learners to take personal responsibility for defining their own questions; accepting and (more often) rejecting information in order to answer those questions; and using that information in both critical and creative ways to engender personal, actualizable knowledge. Its emphasis on *evaluating* information and *applying* it in order to *generate* this new knowledge places its focus directly on the higher levels in Anderson and Krathwohl's (2001) revision of Bloom's *Taxonomy*

In practical terms, **I-LEARN** provides both a description of the process of learning with information and a strategy that can be taught and used to invoke that process successfully. By "operationalizing" learning with information in six categories and a few elements within each, the model not only offers a clear and succinct way to explain what happens when we use information as the basis for our learning but also suggests a straightforward process that teachers and library media specialists can use to help students master the task of learning in the information age. Validating the model in practice will establish its utility as a learning tool.

Validation

Plans are currently underway to validate the model within the digital environment offered by the Internet Public Library (IPL) as well as in face-to-face environments. Specific steps in the planned validation will include:

1. creating a tutorial on the model and a tracking mechanism related to its use to be incorporated into the IPL,
2. tracking high-school students' use of the model, and
3. enriching and validating the model and the tutorial based on the evaluation of this student use,
4. creating a series of curriculum applications based on findings related to how the model is used, and
5. testing these applications within several face-to-face environments.

First, a tutorial based on the model will be designed, developed, and incorporated as a "Hot Topics" link within the Teen Space area of the IPL (http://wwww.ipl.org/div/teen/). Simultaneously, tracking mechanisms based on existing tools within the IPL will be designed and developed to track students' use of the tutorial to determine which components of the tutorial/model are more and less successful and why. Next, students' use of the tutorial will be tracked throughout an academic year. Then, the model/tutorial will be revised to correct any flaws and to incorporate any enhancements suggested by the field trial. Finally, curriculum applications based on the revised model will be designed and developed collaboratively with library media specialists in one or more

school districts and tested within the face-to-face environments available to those library media specialists.

Phase 1

The process of creating a tutorial based on **I-LEARN** will be guided by the general steps of the instructional design approach that have been in place for over thirty years. In particular, the development will use the eight steps of the model created by Turner & Riedling (2003): identifying what the learners in the target audience need to know; stating learning goals and objectives; designing assessments; detailing the content; developing the instructional strategies and activities (i.e., the tutorial itself); evaluating what students have learned; determining how well the tutorial helped them with that learning; and revising the materials accordingly. The Turner & Riedling model has advantages over other basic instructional design models (e.g., Dick, Carey, & Carey, 2008; Morrison, Ross, & Kemp, 2007) because it was developed specifically for the K-12 environment and because it incorporates guidance for the collaboration of teachers and library media specialists in the design process.

At the same time, a tracking framework will be designed to determine how students access and use **I-LEARN** within the Internet Public Library (IPL). Developed by Dr. Joseph Janes and a group of students at the University of Michigan's Information School in 1995, the IPL is a collaborative service of LIS educators, students, and volunteer librarians working together to provide (a) access to an authoritative online collection and (b) a web-based reference service for the public at large. In January 2007, sponsorship of the IPL was moved to Drexel University, with oversight shared by Drexel, the University of Michigan, and Florida State University. The IPL has collections in ten subject categories that consist of approximately 40,000 links. The collections have been selected by IPL staff according to criteria delineated in the IPL collection development policy (http://www.ipl.org/div/about/colpol.html). From January 1 through December 29, 2008, the IPL logged approximately 34 million pageviews as a whole from about 7.3 million unique visitors.

The tracking framework to be developed will allow several kinds of analysis of students' use of **I-LEARN** within the IPL—as a whole, through its individual categories, and through its specific elements. Embedded directly within the **I-LEARN** tutorial, the tracking framework will include (1) a function that tracks students' use of each of the categories and elements of the model, (2) a function that tracks students' location and use of specific IPL resources as they move through the tutorial, (3) questions and answers embedded within the tutorial designed to assess students' understanding of and use of individual components of the tutorial itself, and (4) concluding survey questions designed to gain students' insights about the strengths and weaknesses of the **I-LEARN** approach in general and the tutorial in particular as well as their suggestions for improvements.

Phase 2

The tutorial and the associated tracking framework will be made available to all users of the IPL. Tracking data will be collected from users who identify themselves as high school students but provide no other identifying data. Collecting such data automatically will allow the project access to student data—which is generally difficult to obtain because of the policies and procedures inherent in many school districts. The fact that tracking results are automatically anonymized means that data collection and analysis can be classified as exempt from Human Subjects' Review. And the wealth of resources available as well as data about the extensive use of the IPL in the past suggests that there will be more than adequate data to analyze and that data will be collected from users addressing a wide range of curricular topics. The paths of students who use the IPL for various kinds of projects will be extracted to provide the basis for the vignettes related to the **I-LEARN** model that will be created in Phase 3.

Data analysis will consist of monitoring students' use of the model to identify patterns that suggest which of its categories and elements are more and less useful to students. For example, it is anticipated that several of the elements of the "Evaluate" step might be difficult for students and require revision: "authenticity," for instance, is a difficult concept for novice learners like high school students to grasp. Moreover, other elements within **I-LEARN** might emerge as students interact with the model and the IPL resources: "organize," for instance, might encompass structures beyond those already included in the model that might be more useful in this environment. By identifying patterns in use/lack of use and targeting areas in need of additions or deletions in the model's specific steps, the tracking data will begin to suggest ways to improve the model as a learning tool.

Phase 3

The model and tutorial as well as the ways in which the tracking mechanism works will be revised based on the data described above, correcting flaws and adding enhancements as appropriate. Although it is impossible to describe such revisions at present, it is anticipated that the model, the tutorial, and the tracking method will all be adjusted and that the revised "package" will allow for continuing research into the usefulness and effectiveness of the model.

Phase 4

A series of vignettes based on the kinds of questions that engaged students during the field trial will be designed and developed for testing in face-to-face environments. Curriculum areas that emerge from the data analyses as widely used will determine the nature of these vignettes. For example, if biology emerges as a particularly salient area, several biology vignettes will be created; if history emerges, several history vignettes will be developed. In addition, suggestions for how teachers might use IPL resources in conjunction with **I-LEARN** to enhance students' ability to access, evaluate, and use information across the curriculum will be developed at this time.

Figure 1 suggests the nature and format of the vignettes that will be developed. Of course, the findings from the field study and might alter this format, which is provided

here simply as an illustration. It is also important to note that the scenario is simplified and described in a linear fashion for the purposes of efficient presentation. In fact, any **I-LEARN** activity is by its nature iterative, offering possibilities for looping at each category and element. Therefore, the actual vignettes will also suggest alternative ways students might address problems (e.g., alternatives to focusing on the canopy, on birds, etc.). They will also recommend particular resources in the IPL, as library pathfinders and applications like WebQuests do in other venues.

Phase 5

These vignettes will form the basis for the face-to-face evaluations envisioned for **I-LEARN** in several school districts in the mid-Atlantic region of the United States. Experienced library media specialists will be involved in designing and implementing learning activities built on the model that can be integrated into ongoing instruction. These activities will involve students in **I**dentifying authentic topics both within and beyond the curriculum, **L**ocating information about them in a wide range of information sources, **E**valuating the information to assess its utility, **A**pplying the "best" information to develop a deep understanding of the topics and to solve related problems about them, **R**eflecting on their work, and summarizing their k**N**owledge gained as a result of their efforts. Several library media specialists have expressed interest in this project, and it is hoped that the collection of vignettes, learning activities, and applications within the Internet Public Library will grow in the coming years.

Conclusion

The **I-LEARN** model bridges the fields of information science and instructional/learning science by drawing on components of each to create a way to think about learning that responds directly to the actualities of a world brimming with information. While this blending of information seeking and learning has been in the literature for over a decade, the **I-LEARN** model is the first to combine them in a construct that is grounded in both theory and research and that has practical implications as well. Providing this bridge is the most significant contribution of the model.

LIFE IN THE CITY
A Seventh-Grade Social Studies Activity

Identify:
Activate: What makes city living special?
Scan: Skyscrapers are uniquely found in cities.
Formulate: What do skyscrapers tell me about life in the city?

Locate:
Focus: How do height limitations affect a city's construction of skyscrapers?
Select: Books, databases, city records, newspaper archives, conversations with planning and other city officials, etc.
Extract: Specific information about cities of interest (e.g., Washington, DC, which has limitations; Chicago, IL, which does not; Philadelphia, PA, which once had limitations but now does not)

Evaluate:
Authority: Creator of information, opinion vs. fact, internal logic, etc.
Relevance: U.S. vs. European cities, new cities in Dubai, etc.
Timeliness: Accessibility, historical vs. contemporary perspective, etc.

Apply:
Generate: Height limitations have both advantages and disadvantages.
Organize: List advantages/disadvantages; sort photos of skyscrapers and of cities with/without height limitations, etc.
Communicate: Podcast (audio and video)

Reflect:
Review: Is the information accurate, complete, balanced, etc.? Are the photos clear, illustrative of key concepts, etc.?
Revise: Find more information, add/delete pictures/narrative, etc.
Finalize: Crop photos, re-record segments of narrative, etc.

kNow:
Personalize: Acknowledge individuality of viewpoint, conclusions
Integrate: With what is known about own city, state capital, other cities, etc.
Activate: Explain in conversations with friends, use as basis for projects, ask related questions, etc.:
What happens in a city when height limitations are dropped?
What does zoning have to do with buildings in cities?
What do other kinds of buildings tell me about life—e.g., shopping malls, libraries, cathedrals?
What makes rural (or suburban) living special?

Figure 1

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Statement of Originality

This paper is based upon original scholarship undertaken by the author and was conceived and written by the author alone. It is an update and expansion of earlier work and has not been published elsewhere in this enhanced version. All information and ideas from others are referenced.