Information Literacy: Essential Skills for the Information Age

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ABSTRACT

Information literacy (IL) is the set of skills and knowledge that allows us to find, evaluate, and use the information we need, as well as to filter out the information we don't need. IL skills are the necessary tools that help us successfully navigate the present and future landscape of information. Information and technology affects every person in every possible setting—work, education, recreation. This paper offers an overview of IL focusing on three contexts for successful IL learning and teaching: (i) the information process itself, (ii) technology in context, and (iii) implementation through real needs in real situations. The author covers conceptual understandings of IL, the range of IL standards and models, technology within the IL framework, and practical strategies for effective IL skills learning and instruction in a range of situations.

Keywords: IL, Big6, information problem-solving, critical thinking, information technology, research skills, information skills, information process, technology skills.

1. INFORMATION LITERACY AND CONTEXT

Information and technology literacy is clearly the "basic skills set of the 21st century." This is widely recognised and accepted for all types of workers—entry level to top executives. For example, in 1991 the US Department of Labor's SCANS report stated that competencies for all entry level employees must include the ability to: (i) acquire and use information, and (ii) work with a variety of technologies.[1] This is information and technology literacy for all.

On the top-end, Peter Drucker, well-known management guru stated that "executives have become computer-literate…but not many executives are information literate".[2] Drucker is saying that being able to use computers is not enough. Executives must be able to apply computer skills to real situations and needs. Executives must be able to identify information problems and be able to locate, use, synthesise, and evaluate information in relation to those problems.

Information and technology affects every person in every possible setting—education, public service, and business. Education is fundamentally information-based. That is, every aspect of learning and teaching requires the gathering, processing, and communication of information. In the past in education, there was a reliance on one primary information resource: the textbook. But this is rapidly changing due in large part to the explosion in information technology and networked information. The same is true in public service—citizens are increasingly turning to web-based, electronic sources and services for information. And, today's successful companies are those that focus on meaningful uses of information and technology and hire employees who are able to apply technology to a range of situations. IL services and instruction

are essential components of every 21st Century library and information program. Whether offering direct instruction to users, providing skills-based help functions on websites, delivering one-on-one (physical or virtual) assistance, or even providing meaningful signage in a physical setting, every information and library situation requires helping users to succeed through improving their information skills or understandings. The purpose of any library or information organisation is to meet the information needs of its users. IL, by ensuring that users are effective in seeking and using information, is an important part of fulfilling this purpose.

This paper offers specific conceptual and practical strategies for effective IL skills instruction. In real estate, they talk about the three key elements: location, location, and location. In education, we can say a similar thing about implementing a meaningful IL program: context, context, and context.

There are three essential contexts for successful IL learning and teaching:

- ✂ The information process itself
- ✂ Technology in context
- ✂ Real needs—either work, educational, or personal.

These contexts are essential for effective IL programs at any level or with any age group. The process provides a structure for applying skills that can seem disconnected; technology within the process gives focus and flexibility; and real needs makes IL relevant and transferable. Individually, when users are working on a problem, it's easy to get lost or confused. People are in a much better position to succeed if, at any point in time, they can identify where they are in terms of the three contexts:

Where are they in the information problem-solving process?

How does technology boost their capabilities in terms of specific information skills?

What is the professional or personal need being addressed?

The remainder of this paper will consider IL within each of these contexts in more detail.

2. CONTEXT #1: THE PROCESS

Information is a pervasive and essential part of our society and our lives. Humans are, at their essence, processors and users of information. This is not a recent development. Humans have always been dependent upon information to help them make decisions and guide their actions. Increases in the sheer volume of information and the complexity of information systems, have come about largely because of advances in information technology and the accelerated rate at which we live our lives.IL is the set of skills and knowledge that not only allows us to find, evaluate, and use the information we need, but perhaps more importantly, allows us to filter out the information we don't need. IL skills are the necessary tools that help us successfully navigate the present and future landscape of information.

There are a number of different information skills standards and models that seek to explain the scope of IL including:

- ✂ Carol Kuhlthau's information search process[3]
- ✂ The Big6 approach of Eisenberg and Berkowitz[4]
- ✂ AASL/AECT IL Standards[5]
- ✂ ACRL IL Competency Standards for Higher Education.[6]

Figure 1 is an updated version of various charts authored by Eisenberg and others[7,8] comparing these models of IL that were developed through research, practice, and committee, respectively. This side-by-side view of IL models shows that there are many similarities among them. In fact, there is more agreement than disagreement among the models, as is true of IL research itself. For example, the driving force behind almost all of the models, and many of the findings, is "process"—the understanding that information skills are not isolated incidents, but rather are connected activities that encompass a way of thinking about and using information.

My own approach, the Big6, is the most widely used model in K-12 education, world-wide (www.big6.com). With six major stages and two sub-stages under each, the Big6 covers the full range of information problem-solving actions.

The Big6 is an approach that can be used whenever people are faced with an information problem or with making a decision that is based on information. Students—K-12 through higher education—encounter many information problems related to course assignments. However, the Big6 is just as applicable to professional or personal life.

The Big6 Skills comprise a unified set of information and technology skills (Fig. 2). Taken together, these skills form a process. The process encompasses

Figure 1 — Comparison of information skills process models

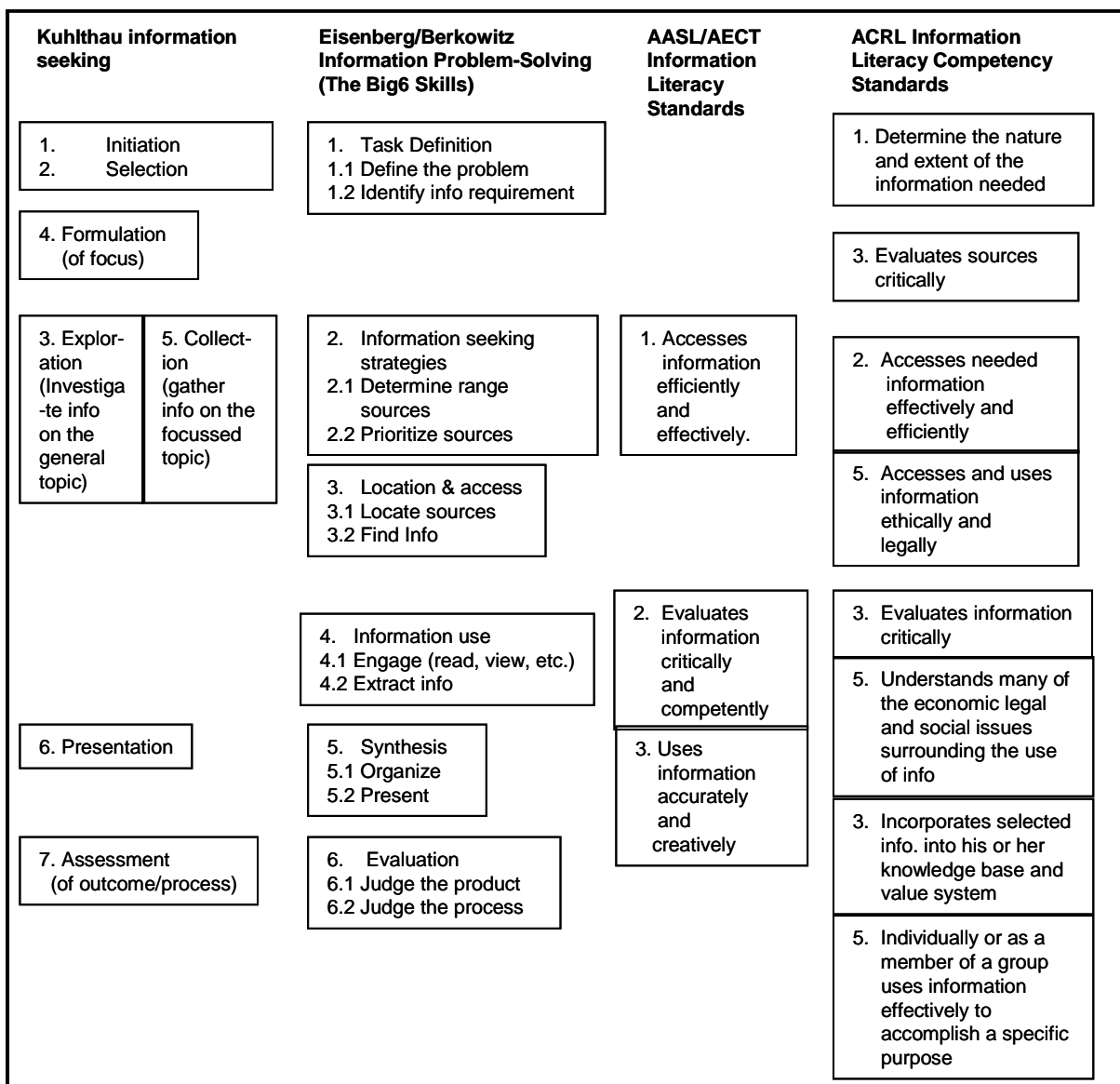| Kuhlthau information seeking	Eisenberg/Berkowitz Information Problem-Solving (The Big6 Skills)	AASL/AECT Information Literacy Standards	ACRL Information Literacy Competency Standards
1. Initiation 2. Selection	1. Task Definition 1.1 Define the problem 1.2 Identify info requirement		1. Determine the nature and extent of the information needed
4. Formulation (of focus)			3. Evaluates sources critically
3. Exploration (Investigate info on the general topic) 5. Collection (gather info on the focussed topic)	2. Information seeking strategies 2.1 Determine range sources 2.2 Prioritize sources	1. Accesses information efficiently and effectively.	2. Accesses needed information effectively and efficiently
	3. Location & access 3.1 Locate sources 3.2 Find Info		5. Accesses and uses information ethically and legally
	4. Information use 4.1 Engage (read, view, etc.) 4.2 Extract info	2. Evaluates information critically and competently	3. Evaluates information critically
6. Presentation	5. Synthesis 5.1 Organize 5.2 Present	3. Uses information accurately and creatively	5. Understands many of the economic legal and social issues surrounding the use of info
7. Assessment (of outcome/process)	6. Evaluation 6.1 Judge the product 6.2 Judge the process		3. Incorporates selected info. into his or her knowledge base and value system
			5. Individually or as a member of a group uses information effectively to accomplish a specific purpose

Figure 1. Comparison of information skills process models.

the Big6, people learn how to recognize their information needs and how to progress through a series of stages to solve information problems effectively and efficiently. Many problem-solving models provide a set of specific activities, or outline of isolated skills. These models may encourage a lockstep strategy that forces one specific method for problem-solving and decision-making. Like these others, the Big6 approach is systematic; however, it differs in a significant way. Big6 Skills provide a broad-based, logical skill set that can be used as the structure for developing a curriculum or the framework for a set of distinct problem-solving skills. These fundamental skills provide students with a comprehensive set of powerful skills to conquer the information age.

But the Big6 is more than simple a set of skills—it is also an approach to helping students learn the information problem-solving process. Learning more about the Big6 as a process and as an approach should make it easier and more useful for any instructors and students. For instructors, the Big6 provides a definitive set of skills that students must master in order to be successful in any learning context. Teachers can integrate instructional modules or lessons about the Big6 into subject area content and assignments. For students, the Big6 provides a guide to dealing with assignments and tasks as well as a model to fall back on when they are stuck. The Big6 represents "metacognition"—an awareness by students of their mental states and processes.

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┌─────────────────────────────────────────┐
│  1. Task Definition                      │
│        1.1 Define the problem            │
│        1.2 Identify the information needed│
│  2. Information seeking strategies       │
│        2.1 Determine all possible sources│
│        2.2 Select the best sources       │
│  3. Location and Access                  │
│        3.1 Locate sources                │
│        3.2 Find information within sources│
│  4. Use of Information                   │
│        4.1 Engage (e.g., read, hear, view)│
│        4.2 Extract relevant information  │
│  5. Synthesis                            │
│        5.1 Organise information from multiple sources│
│        5.2 Present information           │
│  6. Evaluation                           │
│        6.1 Judge the result (effectiveness)│
│        6.2 Judge the process (efficiently)│
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Figure 2. The Big6.[9]

From experience and research, we found that successful Big6 information problem-solving does require completing each stage at some point in time: defining the task; selecting, locating, and using appropriate information sources; pulling the

information together; and deciding that the task is in fact completed. However the stages do not need to be completed in any particular order or in any set amount of time. A stage can be repeated or revisited a number of times. Sometimes a stage is completed with little effort, while at other times a stage is difficult and time consuming.

From experience and research, we found that successful information problem-solving does require completing each stage at some point in time: defining the task; selecting, locating, and using appropriate information sources; pulling the information together; and deciding that the task is in fact completed. However, the Big6 is not linear and prescriptive. It's not necessary to complete the stages in order, however all the stages must be completed for overall success.

Figure 3 illustrates that the Big6 is not necessarily a linear, step-by-step process. For example, imagine that after a team has defined a task and decided on their information seeking strategies in terms of three specific sources, they find them unavailable.
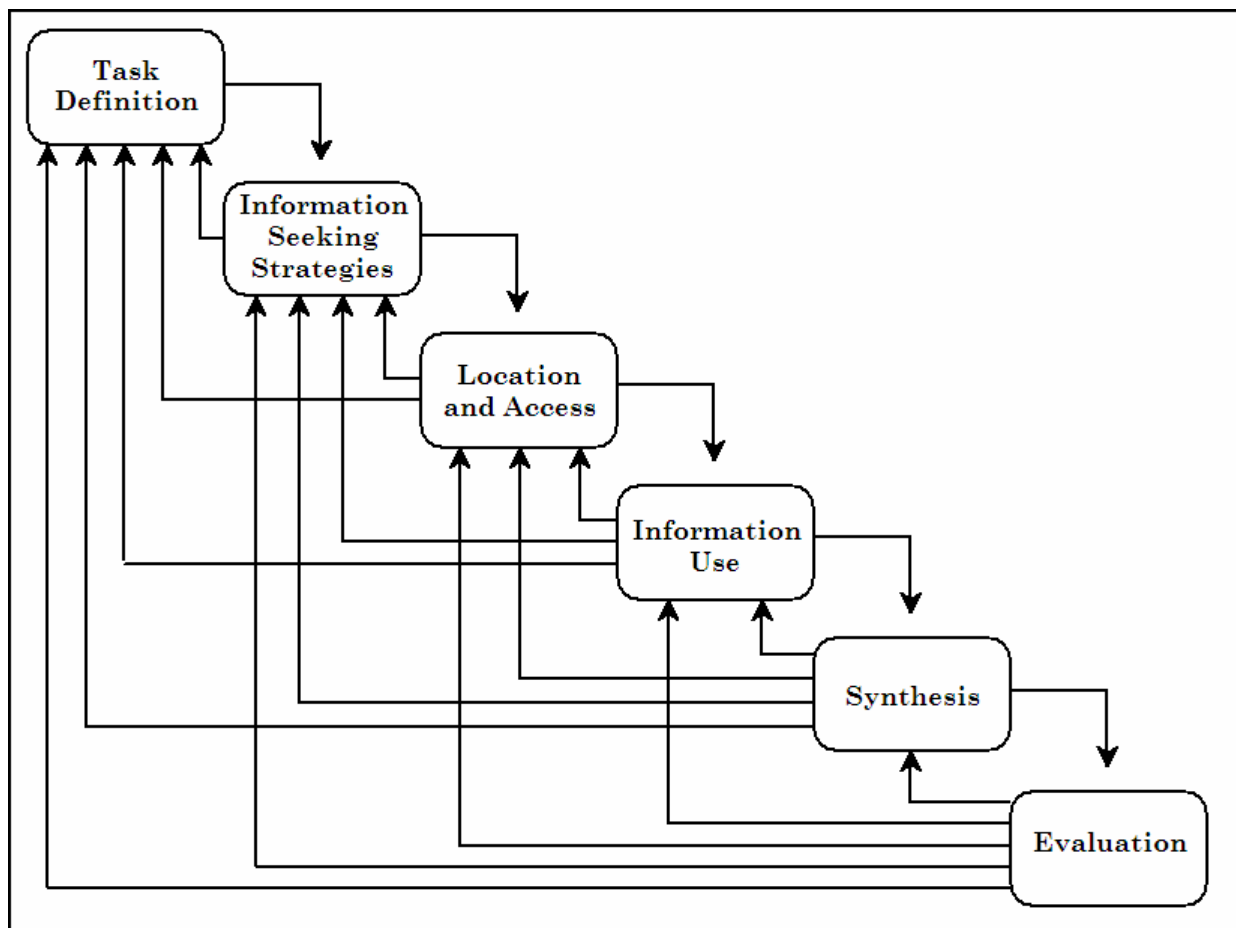

Figure 3. The Big6 as a feedback process.

In that case, they would loop back to information seeking strategies to reformulate their plans. Or, suppose when compiling a report (synthesis), a manager isn't sure if he/she has done everything required. Here, he/she would jump back to task definition to review the problem and requirements. The point is to be flexible and able to move back and forth in the process, but to be able to do what is essential in each stage.

From a learning perspective, knowing where you are in a process is very helpful for anyone. It helps to know what's been completed and what is still to do. When working on an assignment, project, report, or even an information problem of personal interest, users should be able to identify where they are in the process. For example, are they reading an article related to current events? That's Use of Information, Big6 #4. Are they searching for sources using a periodical database or search engine? That's Big6 #3, Location & Access.

From a teaching perspective, it's important to anchor instructional and learning experiences related to information and technology skills instruction within the information process. For example, teaching *PowerPoint* for organizing and presenting oral presentations—that's Synthesis, Big6 #5. Working with users to determine the most appropriate and available sources for a project—that that's Information Seeking Strategies, Big6 #2.

Connecting instruction of individual skills or techniques within the overall Big6 process provides users with a familiar reference point. They see the links among seemingly separate skills and are able to reflect on what came before and anticipate what comes after.

Therefore, we recommend continually working with users to help them recognize where they are in the process. Some ways that educators can do this is by:

✄ Identifying for users the various information process stages as they go through to complete an assignment, project, report, or even to make a personal decision

✄ Using a narrative or self-reflection to point out the Big6 related to the actions of one or more characters

✄ Modeling information process recognition by pointing out when they themselves are engaging in a particular information stage

✄ Asking users, verbally or in writing, to identify which information stage they are working on

Some would call this a metacognitive approach. The Big6 (or any other process model) gives students a vocabulary to describe process and become more self-aware. By continually emphasizing a "process context," users learn to recognize their own styles as well as their strengths and weaknesses. They also have a model to fall back on should they get stuck or have difficulties.

3. CONTEXT #2: TECHNOLOGY FOR INFORMATION PROBLEM-SOLVING

There seems to be increasing understanding among educators as well as in the general public that technological proficiency is more than simply knowing particular set of commands or even how to use a particular type of software. We want students to use technology flexibly and creatively. We want them to be able to size up a task, recognize how technology might help them to fulfill the task, and then use the technology to do so. People need to be able to use computers for a purpose.

Helping people—especially students—learn to apply technology in these ways requires a change in the way computer skills are traditionally taught. It means moving from teaching isolated "computer skills" to teaching integrated information and technology skills. From an IL perspective, that means integrating computer skills within the information problem-solving process. Individual computer skills take on a new meaning when they are integrated within a process, and students develop true "computer literacy" because they have genuinely applied various computer and technology skills as part of learning.

Moving from teaching isolated computer skills to helping people learn integrated information and technology skills is not just a good idea—it's essential if we are to put users in a position to succeed in an increasingly complex and changing world. Drucker's point about executives not being information literate (see endnote 2) is still true today. Being able to use computers is not enough. Executives all must be able to apply computer skills to real situations and needs. Executives must be able to identify information problems and be able to locate, use, synthesize, and evaluate information in relation to those problems. These same needs exist for all people living in an information society.

There are many good reasons for moving from teaching isolated computer skills to teaching integrated

information and technology skills. Technology is changing at a breath-taking pace and will continue to do so for the foreseeable future. Bill Gates once said (National Educational Computing Conference, 1996) that computing power has increased 1 million times over the past 20 years and will likely do so again in the next 20 years!

A million times more powerful. Will learning isolated specific skills such as word processing, electronic spreadsheets, and even World Wide Web searching suffice? Clearly not. Will learning to use whatever technologies come along to boost our skills within the overall information problem-solving process? Absolutely! That's what it means to look at technology from an information skills perspective.

Consider a common technology—"a pencil and paper." From an information process perspective, how can a pencil and paper help us to be more productive? Clearly, a pencil and paper boosts our ability to present information. In the Big6 process, this is Big6 #5—synthesis. What are the electronic equivalents of a pencil and paper—the tools that help us even more to synthesize? Clearly, there's word processing. There's also desktop publishing, word processing, desktop publishing, *PowerPoint* and other presentation software programs. All these are used to organize and present information, Big6 #5.

Reflect on another common technology—"a phone book." The phone book is a tool for accomplishing Big6 #3—Location and Access. Electronic equivalents to the phone book are online library catalogs, periodical databases, and of course, web search engines.

Any technology can be analyzed in this way—as part of the information problem-solving process.

Web pages, electronic reference resources, Q&A services, are all part of an effective Information Seeking Strategy (Big6 #2) and when we engage them and extract relevant information that's Big6 #4—Use of Information. E-mail, chat, or text messaging is highly useful for linking students with their teachers or with other students for Task Definition activities (Big6 #1), and later for Evaluation (Big6 #6).

When integrated into the information problem-solving process, these technological capabilities become powerful information tools for students. Table 1, a summary of how some of today's technologies fit within the Big6 process and Table 2 flips it around—considering technology within the process. This is the most powerful way to consider technology—as a boost to people's abilities—within the information problem-solving process.

4. CONTEXT #3: REAL NEEDS

As noted earlier, information is a pervasive and essential part of our society and all our lives. Information is pervasive, and so are information skills. Therefore, there are many opportunities for teaching and learning the IL. From research and experience, we know that the information skills are best learned in the context of real needs—school or personal. Students today, more than ever, want to see connections between what they are learning and their lives. They want to know how something is relevant. We need to take advantage of this and emphasize the applicability of information skills across environments and situations.

In school settings, the context for IL instruction is the curriculum. In K-12, this includes the subject

Table 1. Technological capabilities and the Big6

Technology	Big6 Stage	Description
Word processing	5 4	Synthesis Use of information (notetaking)
Spell/grammar checking	6	Evaluation
Presentation/Multimedia software	5	Synthesis
Electronic spreadsheets	5	Synthesis
Online library catalog	3	Location & Access
Search engine	3	Location & Access
Full-text electronic resources	2 4	Information seeking strategies Use of information
E-mail	1-6	All (particularly Task Definition, Evaluation)
Copy-paste (in various programmes)	4	Use of information

Table 2. The Big6 and Technology

Stage	Big6	Technology
1	Task definition	e-mail, group discussions (listservs, online forums), brainstorming software, chat, videoconferencing, groupware
2	Information seeking strategies	online catalogs, info retrieval, networked electronic resources, Intranet), Web resources, digital reference services, online discussin groups, blogs, wikis
3	Location & Access	online catalogs, electronic indexes, search engines, browsers
4	Use of information	upload/download, word processing, copy-paste, outliners, spreadsheets, databases (for analysis of data), statistical packages
5	Synthesis	word processing, desktop publishing, graphics, spreadsheets, database management, presentation software, down/up load, e-journals, blogs, wikis, web-authoring
6	Evaluation	e-mail, group discussions (listservs, online forums), brainstorming software, chat, videoconferencing, groupware

area units and lessons of study. In higher education, we focus on courses, class topics, and lectures. Most importantly in both, the emphasis should be on the assignments on which students will be evaluated. Throughout the academic year, teachers and students engage in a rich range of curriculum subjects, topics, and assignments. In fact, one of the current problems we face in education is "curriculum information overload"—there's just too much to cover in limited time.

That's why, in implementing information skills instruction, we do not promote adding new curriculum content, units, or topics. There's plenty going on in the curriculum already. The last thing that faculty and students need is more content. Therefore, from an IL perspective, the challenge is to determine good opportunities for learning and teaching information skills within the existing curriculum. To do so involves the following actions:

Analyse the curriculum to

� Select topics and assignments which are well-suited to information skills instruction

✂ Determine which skills are particularly relevant to the selected curriculum topics and assignments.

✂ Develop a broad plan that links the information skills program to various curriculum topics

✂ Design integrated topic and lesson plans to teach information skills in the context of the subject area curriculum

We strongly advocate a collaborative approach to information instruction. That is, classroom teachers, librarians, technology teachers, and other educators can work together to analyze the curriculum, develop a broad plan, and design specific unit and lesson plans that integrate the information skills and classroom content. These educators can also collaborate on teaching and assessment.

Effective information skills instruction starts with selecting existing curriculum units which are best suited to integrated instruction. In the Big6 program, we refer to these units as "big juicies"—those information-rich curriculum units that are filled and dripping with Big6 potential. "Big juicy" units are rich in information needs, resources, and processing. These are the units that offer particularly good opportunities for teaching specific Big6 Skills within the overall Big6 process, for example:

✂ Units or topics that involve a report, project, or product rather than those that rely on a test for assessment

✂ Units that require a range of multiple resources rather than only the textbook

✂ Units that reach a large number of students and span a reasonable timeframe.

The following is an example of how this might work in practice. It is on the high school level, but the same approach can work in elementary or middle school, higher education, or even in public library, business, or community situations.

High school biology teacher, Ms Lowe, and library media specialist, Mr Bennett, meet to discuss how they might collaborate to help students improve their information problem-solving skills while they study biology. They analyze the major units that Ms Lowe plans to teach during the school year, and

agree that there are three key units because they (i) result in some form or product of project, (ii) require lots of different types of resources, (iii) involve the whole class, and (iv) span more than just a week or two. In other words, these three units seem to be particularly "information-rich," and are perfect candidates for integrated biology—Big6 instruction. These are the big juicies:

The anatomy unit: taught early in the school year, takes three weeks, involves significant use of the WWW, results in individual *PowerPoint*-supported oral presentations.

The circulatory system unit: taught in the second marking period, takes two weeks, involves a series of worksheets that combine to make a study guide, also requires students to identify structures and functions, and to analyse the effect of oxygenation on various other systems (e.g., nervous system, immune system, digestive system).

The digestive system unit: taught in the third marking period, results in group presentations on the digestive process in different animals, and usually involves extensive information seeking and searching.

What now? Do they select among these units or do they just integrate the Big6 with all three? Do they teach all the Big6 Skills with each unit or focus on specific information skills?

These choices depend upon other factors including the time available for Big6 instruction and what else is going on during the school year. We do, however, recommend that while they review and reinforce the overall Big6 process with each unit, Ms. Lowe and Mr. Bennett should provide targeted Big6 Skills instruction on one or two of the specific skills. For example:

The anatomy unit relies on *PowerPoint* and the Web, so lessons can be taught on both. *PowerPoint* is a synthesis tool, so that's a Big6 #5 lesson focusing on organising and presenting principles using *PowerPoint*. Lessons on the Web might focus on identifying useful types of websites (Information Seeking Strategies, Big6 #2), using keyword search terms (Location & Access, Big6 #3), and recognising and extracting relevant information, (use of Information, Big6 #4).

The circulatory system unit might be a good unit in which to focus on Task Definition, Big6 #1, since each worksheet has a different focus. There's also a great deal of targeted analysis, so Use of Information, Big6 #4, is again important.

The digestive system unit is a group project and comes later in the school year. This would be a good opportunity to review the entire Big6 process while emphasizing defining tasks and dividing up the work (Big6 #1—Task Definition) and how to put group presentations together so they make sense and flow easily (Big6 #5, Synthesis). Evaluation (Big6 #6) can also play a big role in group projects as students may be required to judge themselves and other group members or to assess the final products of other groups.

In actual school settings, selecting topics for integrated instruction and overall information skills planning depends upon the specific needs of the students as well as the setting and situation. The ultimate goal is to provide frequent opportunities for students to learn and practice information problem-solving.

Repetition is crucial. While these skills may seem to be simple or common sense at first, they actually are quite involved and can be difficult to master. This point cannot be overstressed—we learn through repetition. It's not enough to teach a skill or sub-skill once. Students' proficiency with specific skills as well as the overall process will improve over time—if they have regular opportunities to learn and to apply the information problem-solving process.

5. CONCLUSION

We live in a very complex and often overwhelming information world. Information, library, and education organizations have a responsibility to do our best to help people succeed. Our job is to meet people's information needs. The school librarians say it even more boldly and directly: "The mission of the school library media program is to ensure that students…are effective users of ideas and information."[10] This is an audacious and highly ambitious statement—and it's right on target.

Providing services, resources, and facilities is one way that libraries, schools, and other organizations seek to meet needs. The other way we do so is to teach and to provide opportunities to learn. If we truly believe that information and technology skills are essential for success, then we must make sure that people have frequent opportunities to learn and practice these skills. Systematic planning and delivery of integrated information skills instruction across settings is essential if we are to make a difference.It's not enough to work one-on-one or to offer an isolated lesson in note taking or Web search engines. People need lessons in the full range of skills, delivered

in the contexts of the overall information process, including relevant technologies, and based in real, subject area assignments. Accomplishing comprehensive, integrated IL instruction requires library and information professionals in collaboration with others to make a concerted and systematic effort to plan and deliver programs in context.

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Dr Mike Eisenberg, a leading scholar in information literacy programme development and research, is the "founding dean" of the Information School at the University of Washington, serving from 1998 to 2006. During his tenure, Mike transformed the unit from a single graduate degree programme into a broad-based information school with a wide range of research and academic programmes.

Mike is also widely known for his work in information literacy including creating (with Bob Berkowitz) the Big6 approach. He has worked with thousands of people in education, business, government, libraries, and communities to improve their information and technology skills. Mike's current efforts focus on information literacy, the expanding role of libraries, and information science education K-20.