Looking at ICT Literacy Standards
Through the Big6™ Lens

Evolution of Information Literacy National Standards

Traditionally, schools taught the three R's: reading, 'riting and 'rithmetic. "Literacy" was captured in international census data by estimating the percentage of people who could read and write. The term "information literacy" first appeared in the mid-1970s as awareness grew that information was becoming an overwhelming and unmanageable deluge. Twenty years ago, the American Library Association codified a definition that provided the basis for subsequent discussion: "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" ("Final Report of the American Library Association Presidential Committee on Information Literacy" (1989) *qtd. in* Spitzer 22). In other words, "literacy" implies more than vocabulary and awareness; it requires critical thinking.

This connotation of "literacy"—one that includes interpretation and evaluation of a medium of expression—has been applied in many different contexts. One reads about visual literacy, media literacy, textual literacy, numerical literacy, technology literacy, and network literacy. In each case, the author expects the word "literacy" to suggest a complex of skills, including analysis, evaluation, synthesis, and application. Merely teaching reading and writing is no longer sufficient, although those are certainly the foundational skills upon which all other literacies are built.

The American Library Association (ALA) and the American Association of School Librarians (AASL) have made significant efforts to guide policy-making and standards development related to information literacy. The July, 1998

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edition of *Information Power: Building Partnerships for Learning* was a result of the collaboration between AASL and the Association for Educational Communications and Technology (AECT). *Information Power* presented "Information Literacy Standards for Student Learning" that were subsequently incorporated in "Indicators of Schools of Quality" by the National Study of School Evaluation. This powerful collection of nine standards and 29 indicators of proficiency in information literacy, independent learning, and socially responsible use of electronic information provided the foundation for interdisciplinary research activities that promote critical thinking and the acquisition of the information-processing skills necessary for future success.

In October 2007, the American Association of School Librarians (AASL) adopted revised "Standards for the 21st-Century Learner," dividing the standards into four major descriptors, each of which is amplified by characteristic skills, self-assessment strategies, dispositions, and responsibilities. Although the educational landscape continues to shift and adapt as we discover more about the learning process, critical thinking and information processing skills are no less important. "The learning standards begin by defining nine foundational common beliefs," including the following:

- Inquiry provides a framework for learning.

- Ethical behavior in the use of information must be taught.

- Technology skills are crucial for future employment needs.

- The definition of information literacy has become more complex as resources and technologies have changed.

- The continuing expansion of information demands that all individuals acquire the thinking skills that will enable them to learn on their own. (AASL, 2007)

National Educational Technology Standards (NETS)

Twenty years ago, as computers became essential in the workplace and dribbled into schools, "computer literacy" entered the curriculum, usually in the form of an introduction to the new vocabulary of bits and bytes, hardware and software. Computer courses focused on programming languages. "Keyboarding" replaced typing.

As computers became more widely available in schools, educators realized that computers should be integrated into instruction rather than taught as a separate course. Using technology to gather and synthesize information in order to solve problems and make decisions is an essential skill for 21st century employees. The NETS Project, an initiative of the International Society for Technology in Education (ISTE), asserts that,

"To live, learn, and work successfully in an increasingly complex and information-rich society, students must be able to use technology effectively. Within an effective educational setting, technology can enable students to become:

- Capable information technology users

- Information seekers, analyzers, and evaluators

- Problem solvers and decision makers

- Creative and effective users of productivity tools

- Communicators, collaborators, publishers, and producers

- Informed, responsible, and contributing citizens" (NETS Intro)

In collaboration with an impressive array of curriculum associations and education organizations, ISTE developed the National Educational Technology Standards for Students in 1998. The original NETS for Students were grouped into six categories, four of which emphasized technology as a *tool* to facilitate productivity, communication, research, and problem-solving and decision-making. The indicators related to standards for research and problem-solving echo the information literacy standards: students must be able to locate, evaluate, and use information effectively in collaborative efforts to solve real-world problems. In early 2007,

ISTE began soliciting comments on a revision of the NETS standards: "As technology, resources, practices, and assessments change over time, it is necessary to review and refresh the standards" (NETS Refresh). As with the revision of the AASL information literacy standards, information fluency and critical thinking skills are still emphasized in the revised NETS standards, published in June, 2007.

Defining and Testing ICT Literacy

National organizations invested in the future of American education continue to refine and elaborate the technology skills and abilities necessary for success.

In remarks at the 2003 ICT Literacy Summit, Assistant Secretary for Technology Policy (U.S. Department of Commerce) Bruce Mehlman commented:

"Raised amidst pervasive, multi-gigabit wireless networks, the high school class of 2030 will be a truly digital generation, more empowered—and more challenged— than any who have come before.

Information and communications technologies are changing everything, transforming organizations, and redefining the skills and talents needed to succeed in the 21st century. At

Figure 1-1: Similarities between National Information and Technology Literacy Standards

ICT Literacy Proficiencies (ETS, 2002)	Standards for the 21st-Century Learner (AASL, 2007)	NETS-S (ISTE, 2007)
Define: the ability to use ICT tools to identify and appropriately represent an information need.	1.1.3 Develop and refine a range of questions to frame the search for new understanding. 1.2.1 Display initiative and engagement by posing questions and investigating the answers beyond the collection of superficial facts.	3a. plan strategies to guide inquiry. 4a. identify and define authentic problems and significant questions for investigation.
Access: the ability to collect and retrieve information in digital environments.	1.1.4 Find, evaluate, and select appropriate sources to answer questions. 1.1.8 Demonstrate mastery of technology tools for accessing information and pursuing inquiry.	4c. collect and analyze data to identify solutions and/or make informed decisions.
Manage: the ability to apply an existing organizational or classification scheme for digital information.	2.1.2 Organize knowledge so that it is useful.	1a. apply existing knowledge to generate new ideas, products, or processes. 4b. plan and manage activities to develop a solution or complete a project.
Integrate: the ability to use ICT tools to synthesize, summarize, compare and contrast information from multiple digital sources.	2.1.1 Apply critical-thinking skills (analysis, synthesis, evaluation, organization) to information and knowledge. 2.1.4 Use technology and other information tools to analyze and organize information.	3b. locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media. 3d. process data and report results.
Evaluate: the ability to judge the quality, relevance, authority, point of view/bias, currency, coverage or accuracy of digital information.	1.1.5 Evaluate information found in selected sources on the basis of accuracy, validity, appropriateness for needs, importance, and social and cultural context. 1.1.7 Make sense of information gathered from diverse sources by identifying misconceptions, main and supporting ideas, conflicting information, and point of view or bias.	3c. evaluate and select information sources and digital tools based on the appropriateness to specific tasks.
Create: the ability to generate information by adapting, applying, designing or inventing information in ICT environments.	3.1.4 Use technology and other information tools to organize and display knowledge and understanding in ways that others can view, use, and assess.	1b. create original works as a means of personal or group expression. 2a. interact, collaborate, and publish with peers, experts or others employing a variety of digital environments and media.
Communicate: the ability to communicate information properly in its context … for a particular audience … and in the appropriate venue.	2.1.6 Use the writing process, media and visual literacy, and technology skills to create products that express new understandings. 3.1.6 Use information and technology ethically and responsibly.	2b. communicate information and ideas effectively to multiple audiences using a variety of media and formats. 5a. advocate and practice safe, legal, and responsible use of information and technology.

the individual level, the ability to understand and make use of ICT—digital literacy—is proving essential to employment success, civic participation, accessing entertainment, and education—it is truly revolutionizing how we work, live, play, and learn. Eight of the top 10 fastest growing occupations require computer skills (Bureau of Labor Statistics), with high tech jobs paying—on average—almost twice as much as non high-tech jobs" (ESA).

In early 2001, the Educational Testing Service (ETS) assembled an international panel to examine technology's role in schools and the workplace, and define "information and communication technology literacy." They concluded:

"ICT literacy cannot be defined primarily as the mastery of technical skills… the concept of ICT literacy should be broadened to include both critical cognitive skills as well as the application of technical skills and knowledge. These cognitive skills include general literacy, such as reading and numeracy, as well as critical thinking and problem solving" (Digital Transformation 1).

Subsequently, ETS developed a simulation based assessment that measures "not only knowledge of technology, but the ability to use critical-thinking skills to solve problems within a technological environment" (ETS). The test, now called *iSkills*, focuses on seven proficiencies: the ability to define, access, manage, integrate, evaluate, create, and communicate information in a technology environment. Although initial implementation has been focused on college and university students, it's clear that these abilities are important for K-12 students as well.

Comparison of Information Literacy and NETS Standards

It is worth considering the similarities in the language incorporated in AASL learning standards, NETS, and the ICT Literacy proficiencies defined by ETS. All emphasize the importance of critical thinking and problem-solving skills in a technological environment, exemplified by the need to locate, select, evaluate, analyze, and synthesize vast quantities of information. Figure 1-1 relates the similar characteristics delineated in these documents.

Early reports from the ICT Literacy Test reveal that "while students may be tech savvy when it comes to entertainment, they may not have the critical thinking

skills to perform the kinds of information management and research tasks necessary for academic success" (Katz). There are still profound concerns regarding the American education system's ability to prepare 21st century employees and citizens. "Business leaders report that while the three 'R's' are still fundamental to every employee's ability to do the job, applied skills such as teamwork, critical thinking, and communication are essential for success at work" ("Most Young People Entering the U.S. Workforce Lack Critical Skills Essential for Success.").

The Big6 Connection to ICT Literacy Proficiencies and Academic Content Standards

What are the implications for educators? Traditional "research papers" (cutting and pasting from an encyclopedia) and traditional "library skills" (using the card

Of special interest to grades... K-5 6-8 9-12

Figure 1-3: Big6™ Skills Aligned with National Academic Content Standards and ICT Literacy Standards

Big6™ Skill	Standards for the 21st-Century Learner (AASL, 2007)	NETS-S (ISTE, 2007)	Content Standards	
1. Task Definition	1.1.3 Develop and refine a range of questions to frame the search for new understanding. 1.2.1 Display initiative and engagement by posing questions and investigating the answers beyond the collection of superficial facts.	3a. plan strategies to guide inquiry. 4a. identify and define authentic problems and significant questions for investigation. 4b. plan and manage activities to develop a solution or complete a project.	E/LA: conduct research on issues and interests by generating ideas and questions, and by posing problems.	Sci: Identify questions that can be answered through scientific investigations.
2. Information Seeking Strategies	1.1.4 Find, evaluate, and select appropriate sources to answer questions. 1.1.5 Evaluate information found in selected sources on the basis of accuracy, validity, appropriateness for needs, importance, and social and cultural context.	3c. evaluate and select information sources and digital tools based on the appropriateness to specific tasks.	E/LA: gather, evaluate, and synthesize data from a variety of sources.	SS: identify and use processes important to reconstructing and reinterpreting the past, such as using a variety of sources, providing, validating, and weighing evidence for claims, checking credibility of sources, and searching for causality.
3. Location and Access	1.1.8 Demonstrate mastery of technology tools for accessing information and pursuing inquiry. 1.3.2 Seek divergent perspectives during information gathering and assessment.	3b. locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.	SS: locate, access, organize, and apply information about an issue of public concern from multiple points of view.	Math: formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.
4. Use of Information	1.1.7 Make sense of information gathered from diverse sources by identifying misconceptions, main and supporting ideas, conflicting information, and point of view or bias. 2.1.1 Apply critical-thinking skills (analysis, synthesis, evaluation, organization) to information and knowledge. 1.3.3 Follow ethical and legal guidelines in gathering and using information.	4c. collect and analyze data to identify solutions and/or make informed decisions. 5a. advocate and practice safe, legal, and responsible use of information and technology.	E/LA: gather, evaluate, and synthesize data from a variety of sources.	Sci: Use appropriate tools and techniques to gather, analyze, and interpret data.
5. Synthesis	2.1.4 Use technology and other information tools to analyze and organize information. 3.1.4 Use technology and other information tools to organize and display knowledge and understanding in ways that others can view, use, and assess.	2a. interact, collaborate, and publish with peers, experts or others employing a variety of digital environments and media. 2b. communicate information and ideas effectively to multiple audiences using a variety of media and formats.	E/LA: write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.	SS: explore causes, consequences, and possible solutions to persistent, contemporary, and emerging global issues.
6. Evaluation	3.4.1 Assess the processes by which learning was achieved in order to revise strategies and learn more effectively in the future. 3.4.2 Assess the quality and effectiveness of the learning product.	1a. apply existing knowledge to generate new ideas, products, or processes. 5b. exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.		

> ## "Information and communications technologies are changing everything, transforming organizations, and redefining the skills and talents needed to succeed in the 21st century."

catalog to locate materials) are obviously inadequate to the task of empowering an information and communication technology-literate citizenry.

In the Information Age, students must be able to purposefully access information from a variety of sources, analyze and evaluate the information, and then integrate it to construct a personal knowledge base from which to make intelligent decisions. To foster these capabilities, educators must reexamine their assignments and teaching strategies. We must recognize and accept the fact that knowledge is changing so fast that no traditional curriculum can adequately supply students with fact-based learning needed for the challenges they will face. Instead, we must teach them the skills to continue learning independently long after they are out of school.

As a school librarian, one of my primary missions is to collaborate with teachers to design assignments that help students learn to locate, evaluate, collect, and synthesize information. The World Wide Web adds valuable resources to the educator's breadth of available information, but it also challenges us to teach students to use those resources critically. The first barrier to persuading students to be thoughtful consumers of information is that they think everything they need is on the Internet, and that they already know how to find it.

"The most widely-known and widely-used approach to teaching information and technology literacy skills in the world" is the Big6 model developed by Mike Eisenberg and Bob Berkowitz (Big6). The Big6 integrates information search and use skills with technology tools in a systematic process to find, use, apply, and evaluate information to specific needs and tasks. The Big6 is designed to help students learn powerful and effective information and technology problem-solving strategies.

The Big6 Skills can be correlated not only to ICT Literacy standards but academic content standards as well (See Figure 1-3). Educators can use the Big6 Skills to guide students to develop the critical thinking skills that will enable

them to meet ICT Literacy proficiencies. Students use stage 1, Task Definition, to *define* their tasks. They may use a technology tool like *Inspiration* to create a graphic organizer identifying the aspects of the information problem they need to research. Then they use the skills they have learned in stage 2, Information Seeking Strategies, to *evaluate* sources of information. Is a particular Web site credible? Is the author an expert on the topic? Is the information reliable?

In Big6 stage 3, Location and Access, students learn to use subject directories, subscription databases, and Internet search engines to access reliable sources of information appropriate for use in schools. They *manage* and *integrate* the information they've found through stage 4, Use of Information. Finally, they use technology tools like word processors, desktop publishing, *PowerPoint* and Web pages to *create* and *communicate* in stage 5, Synthesis. Although the ETS test does not ask students to *evaluate* their product and process, it is that critical Big6 stage 6 that helps them improve their information and communication technology literacy skills.

If educators promote and use an information problem-solving process like the Big6 Skills, they can help students learn to locate, select, evaluate, analyze, and synthesize information from a variety of sources in order to make intelligent decisions. These are the higher-level thinking skills people can use in any content area, at any level, and can continue to use throughout their lives, no matter what new technology or information systems they encounter. ∎

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