Information, Communications, and Technology (ICT) Skills Curriculum Based on the Big6 Skills Approach to Information Problem-Solving

By Mike Eisenberg, Doug Johnson and Bob Berkowitz

Revised February 2010

There is clear and widespread agreement among the public and educators that all students need to be proficient technology users. Technology literacy is among the attributes that appear in nearly every set of "21st Century skills." However, while districts spend a great deal of money on technology, there seems to be only a vague notion of what technology literacy really means. Can the student who uses technology well enough to play a game, send e-mail or browse the Web be considered technology literate? Will a student who uses technology in school only for running tutorials or an integrated learning system have the skills necessary to survive in our society? Is the ability to do basic word processing sufficient for students entering the workplace or post-secondary education?

Certainly not. Recent publications by educational associations advocate for a more meaningful use of technology in schools (Partnership for 21st Century Skills, 2008.) Educational technologists clearly describe what students should know and be able to do with technology. They advocate integrating technology skills into the content areas, recognize that technology skills should not be taught in isolation, and affirm that separate "computer classes" do not allow students to apply technology skills in meaningful ways. There is increasing recognition that the end result of technology literacy is not knowing how to operate technology, but rather to use technology as a tool for organization, communication, research, and problem solving. This revised focus on technology as a tool is an important shift in conceptual approach and instructional emphasis.

Moving away from teaching isolated technology skills and thereby moving toward an integrated approach is an important step that takes a great deal of planning and effort. Fortunately, we have a model for doing so. Over the past 30 years, library information and technology professionals have worked hard to move from teaching isolated "library skills" to teaching integrated "information skills." They found that information skills can be integrated effectively when the skills (1) directly relate to the content area curriculum and to classroom assignments, and (2) are tied together in a logical and systematic information process model.

Schools that seek to move away from isolated information technology skills instruction will also need to focus on both of these requirements. Successful integrated information skills programs are designed around collaborative projects jointly planned and taught by teachers and library information and technology professionals. Information technology skills instruction can and should be embedded in such a curriculum. Teacher-librarians, technology teachers, and classroom teachers need to work together to develop units and lessons that will include technology skills, information skills, and content-area curriculum outcomes.

A meaningful, unified information technology literacy curriculum must be more than a "laundry list" of isolated skills, such as knowing the parts of the computer, writing drafts and final products with a word processor, and searching for information on the Internet.

While specific, articulated skills are important for students to learn, the "laundry list" approach does not provide an adequate model for students to transfer and apply skills from situation to situation. These curricula address the "how" of technology use, but rarely the "when" or "why." Students may learn isolated skills and tools, but they would still lack an understanding of how those various skills fit together to solve problems and complete tasks. Students need to be able to use technology tools with flexibility, creativity and a genuine purpose. All learners should be able to recognize what goals they need to accomplish, determine whether technology will help them to do so, and then be able to use the technology as part of the process to accomplish their task. Individual technology skills take on a new meaning when they are integrated within this type of information problem-solving process, and students develop true "information technology literacy" because they have genuinely applied various information technology skills as part of the learning process.

The curriculum outlined in this document demonstrates how technology literacy skills can fit within an information literacy skills context [American Association of School Librarians, (1998), (2007); Association of College and Research Libraries (2000)]. The baseline information literacy context is the Big6 process (see sidebar and Eisenberg & Berkowitz, 1988, 1992, 1999, 2000, 2010). The various technology skills are adapted from the International Society for Technology in Education's National Educational Technology Standards for Students (2007) and the Mankato Schools Information Literacy Curriculum Guideline. Students might reasonably be expected to authentically demonstrate these basic technology skills before graduation.

Additional technology literacy competencies that may be relevant in some situations include knowing: (1) the basic operation, terminology, and maintenance of equipment, (2) how to use technology-assisted instructional programs, (3) the impact of technology on careers, society, and culture (as a direct instructional objective), and (4) computer programming.

Defining and describing technology skills is only a first step to assure all our children become proficient information and technology users. Other critical elements will include a teacher-supported scope and sequence of skills, well designed projects, and effective assessments. Equally essential is fruitful collaboration among classroom teachers, teacher librarians, and technology teachers in order to present students with a unified and integrated approach to ensure that all children master the skills they will need to thrive in an information-rich future (Eisenberg & Lowe, 1999).

The **Information, Communications, and Technology (ICT) Skills for Information Problem Solving** curriculum presented below defines technology capabilities and identifies associated skills based on the Big6 Skills Approach. The Curriculum describes levels of technology proficiency, and in so doing, promotes the skills and concepts basic to information and technology. In an information society, it is essential that students are technologically productive and able to solve information problems effectively and efficiently.

This curriculum requires more than teaching computer skills, technology hardware, and software programs in an isolated approach. An effective technology curriculum must be integrated across content areas and grade levels to improve the learning process. Technology is successfully integrated when it seamlessly supports curricular goals. Students learn and refine their technology skills when they work on projects that require them to solve problems and make decisions.

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A Curriculum Based on the Big6 Approach

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1. Task Definition

The first part in the information problem-solving process involves the ability to recognize that an information need exists, to define the problem, and to identify the types and amount of information needed. In terms of technology, students will be able to:

A. Communicate with teachers regarding assignments, tasks, and information problems using e-mail; online discussions (e.g., listservs, threaded Web-based discussions, newsgroups); real-time communications (e.g., instant messaging services, chat rooms, IP telephony); desktop teleconferencing; and shared work spaces on the Internet, intranets, and local area networks.

B. Generate topics, define problems, and facilitate cooperative activities among groups of students locally and globally using e-mail, online discussions, real-time communications, desktop teleconferencing, and shared work spaces on the Internet and local area networks.

C. Generate topics, define problems, and facilitate cooperative activities with subject area experts locally and globally using e-mail, online discussions, real-time communications, desktop teleconferencing, and shared work spaces on the Internet and local area networks.

D. Define or refine the information problem using graphic organizing, brainstorming or idea generating software. This includes developing a research question or perspective on a topic.

E. Use a general online information source such as Wikipedia to read a topic overview and clarify the research subject.

2. Information Seeking Strategies

Once the student formulates the information problem, he or she must consider all possible information sources and develop a plan to find the sources. Students will be able to:

A. Assess the relevance and credibility of various types of electronic resources for data gathering including databases, commercial and Internet online resources, electronic reference works, community and government information, or other forms of electronic resources (e.g., resources in various media or graphics formats).

B. Assess the need for and relevance of primary resources including interviews, surveys, experiments, and documents that are accessible through electronic means.

C. Identify and apply specific criteria to evaluate computerized electronic resources.

D. Identify and apply specific criteria to construct meaningful original data gathering tools such as online surveys, electronic interviews; or scientific data gathering tools such as probes, meters, and timers.

E. Assess the value of e-mail, online discussions, real-time communications, desktop teleconferencing, and collaborative writing, production, and editing tools on the Internet and local area networks as part of a search of the current literature or in relation to the information task.

F. Use systems to generate modifiable flow charts, time lines, organizational charts, project plans (such as Gantt charts), and calendars that will help the student plan and organize complex or group information problem-solving tasks.

G. Use handheld devices such as personal digital assistants (PDAs), smart phones, electronic slates or tablet PCs to track contacts and create to-do lists and schedules.
H. Use a blog, wiki or other collaborative productivity tool to track the research process in real time.

3. Location and Access

After students determine their priorities for information seeking, they must locate information from a variety of resources and access specific information found within individual resources. Students will be able to:

A. Locate and use appropriate technology resources and technology available within the school library information and technology center, including resources on the library information and technology center's local area network (e.g., online catalogs, periodical indexes, full-text sources, multimedia technology stations, online terminals, scanners or digital cameras).
B. Locate and use appropriate information technology resources and systems available throughout the school including resources and technology available through intranets or local area networks (e.g., full-text resources, productivity software, scanners, or digital cameras).
C. Locate and use appropriate information technology resources and systems available beyond the school through the Internet (e.g., newsgroups, mail lists, WWW sites, ftp sites, online public access library catalogs, blogs, wikis, Nings, social networking sites, commercial article databases and online services, and other community, academic, and government resources).
D. Know the roles and technology expertise of people who work in the school information and technology program and elsewhere who might provide information or assistance. Know how to access that assistance both in person and virtually.
E. Use electronic reference materials (e.g., electronic encyclopedias, ebooks, dictionaries, biographical reference sources, atlases, geographic databanks, thesauri, almanacs, fact books) available through intranets or local area networks, stand-alone workstations, commercial online vendors, or the Internet.
F. Use the Internet or commercial technology networks to contact experts and help and referral services.
G. Conduct self-initiated electronic surveys through e-mail, listservs, newsgroups and online data collection tools.
H. Use search engines, tools and commands for searching commercial databases and services, (e.g., Web-based, online, networked or stand-alone services).
I. Use search engines, tools and commands for searching the Internet, e.g., meta search tools, bots, directories, jump pages, and specialized resources such as those that search the Invisible Web.
J. Use organizational systems and tools specific to electronic information sources that assist in finding specific and general information (e.g., indexes, tables of contents, user's instructions and manuals, legends, boldface and italics, graphic clues and icons, cross-references, Boolean logic strategies, time lines, hypertext links, knowledge trees, URLs, and so forth).
K. Use specialized Web sites and search tools and commands that limit searches by date, location, format, collection of evaluated sites or other criteria.

4. Use of Information

After finding potentially useful resources, students must engage (read, view, listen) the information to determine its relevance and then extract the relevant information. Students will be able to:

A. Connect and operate the technology devices and networks needed to access information; and read the guides and manuals associated with such tasks.

B. Know and be able to use the software and hardware needed to view, download, decompress and open documents, files, and programs from Internet sites and archives.

C. Copy and paste information from an electronic source into a personal document complete with proper citation.

D. Take notes and outline with a word processor, database, presentation or similar productivity program.

E. Record electronic sources of information and gather the URL locations of those sources in order to properly cite and credit sources in footnotes, endnotes, and bibliographies. Include any online sites designed to track and store online resources.

F. Use electronic spreadsheets, databases, and statistical software to process and analyze statistical data.

G. Analyze and filter electronic information in relation to the task, and reject information that is not relevant or credible.

H. Save and backup gathered data to secure locations (e.g. to an external memory device or online/cloud storage).

5. Synthesis

Students must organize and communicate the results of the information problem-solving effort. Students will be able to:

A. Classify and group information using a word processor, database or spreadsheet.

B. Use word processing and desktop publishing software to create printed documents, and apply keyboard skills equivalent to at least twice the rate of handwriting speed.

C. Create and use technology-generated graphics and art in various print and electronic presentations.

D. Use electronic spreadsheet software to create original spreadsheets.

E. Generate charts, tables and graphs using electronic spreadsheets and other graphing programs.

F. Use database software to create original databases.

G. Use presentation software to create slide shows and multi-media presentations. Use websites and online services to create and share multi-media products.

H. Create media-rich presentations and use projection devices to show hypermedia and multimedia productions that include digital video, audio files and active links to HTML documents or other programs.

I. Create Web pages and websites using hypertext markup language (HTML) in a text document or by using Web page creation tools; and know the procedure to upload these pages to a Web server.

J. Use e-mail, ftp, shared documents, and other telecommunications capabilities to publish the results of the information problem-solving activity. Know specialized sites for sharing photographs, slide shows, and multi-media presentations.

K. Use specialized technology applications as appropriate for specific tasks (e.g., music composition software, computer-assisted drawing and drafting programs, mathematics modeling software, scientific measurement instruments).

L. Properly cite and credit electronic sources (e.g. text, graphics, sound and video) of information within the product as well as in footnotes, endnotes, and bibliographies.

6. Evaluation

Evaluation focuses on how well the final product meets the original task (effectiveness) and the process of how well students carried out the information problem-solving process (efficiency). Students may evaluate their own work and

process or be evaluated by others (e.g. classmates, teachers, library information and technology staff, parents). Students will be able to:

A. Evaluate electronic presentations in terms of the content and format; and design self-assessment tools to help them evaluate their own work for both content and format.

B. Use the spelling and grammar checking functions of word processing; and use other software to edit and revise their work.

C. Apply legal principles and ethical conduct related to information technology, copyright, and plagiarism.

D. Understand and abide by telecomputing etiquette when using e-mail, newsgroups, listservs and other Internet functions.

E. Understand and abide by acceptable use policies and other school rules related to using the Internet and other electronic technology.

F. Use e-mail, real-time communications (e.g., listservs, newsgroups, instant messaging services, chat rooms, IP telephony) desktop teleconferencing, and collaborative spaces on the Internet and local area networks to communicate with teachers and others regarding their performance on assignments, tasks, and information problems.

G. Thoughtfully reflect on the use of electronic resources and tools throughout the process.

H. Use online resources in ways that guard privacy and increase users online safety and security.

[sidebar]

The Big6 Skills Approach to Information Problem Solving

The Big6 is an information literacy curriculum, an information problem-solving process, and a set of skills which provide a strategy for effectively and efficiently meeting information needs. The Big6 Skills approach can be used whenever students are in a situation, academic or personal, which requires information to solve a problem, make a decision or complete a task. This model is transferable to school, personal, and work applications, as well as all content areas and the full range of grade levels. When taught collaboratively with content area teachers in concert with content-area objectives, it serves to ensure that students are information literate.

The Big6

1. Task Definition

1.1 Define the task (the information problem).

1.2 Identify information needed in order to complete the task (to solve the information problem).

2. Information Seeking Strategies

2.1 Brainstorm all possible sources.

2.2 Select the best sources.

3. Location and Access

3.1 Locate sources.

3.2 Find information within the sources.

4. Use of Information

4.1 Engage in the source (read, hear, view, touch).

4.2 Extract relevant information.

5. Synthesis

5.1 Organize information from multiple sources.

5.2 Present the information.

6. Evaluation

6.1 Judge the process (efficiency).

6.2 Judge the product (effectiveness).

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