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Learning and Teaching Information Technology

Computer Skills in Context

By Michael B. Eisenberg and Doug Johnson

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

Clearly not. In too many schools, teachers and students still use computers only as the equivalent of expensive flash cards, electronic worksheets, or as little more than a typewriter. The productivity side of computer use in the general content area curriculum is neglected or grossly underdeveloped (Moursund, 1995).

Recent publications by educational associations are advocating for a more meaningful use of technology in schools (ISTE, 2000). Educational technologists are clearly describing what students should know and be able to do with technology. They are advocating integrating computer skills into the content areas, proclaiming that computer skills should not be taught in isolation and that separate "computer classes" do not really help students learn to apply computer skills in meaningful ways. There is increasing recognition that the end result of computer literacy is not knowing how to operate computers, but to use technology as a tool for organization, communication, research, and problem solving. This is an important shift in approach and emphasis.

Moving from teaching isolated technology skills to 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 25 years, library media 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 seeking to move 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 media professionals. Information technology skills instruction can and should be imbedded in such a curriculum. Library media specialists, computer teachers, and classroom teachers need to work together to develop units and lessons that will include both 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 using the World Wide Web.

While these specific 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 computer 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 computers and other technologies flexibly, creatively and purposefully. All learners should be able to recognize what they need to accomplish, determine whether a computer will help them to do so, and then be able to use the computer as part of the process of accomplishing their task. Individual computer 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 on pages 2-3 of this ERIC Digest, "Technology Skills for Information Problem Solving," demonstrates how technology literacy skills can fit within an information literacy skills context (American Association of School Librarians, 1998). The baseline information literacy context is the Big6 process (see sidebar and Eisenberg & Berkowitz, 1988, 1992, 1999, 2000). The various technology skills are adapted from the International Society for Technology in Education's *National Educational Technology Standards for Students* (2000) and the Mankato Schools Information Literacy Curriculum Guideline. Students might reasonably be expected to authentically demonstrate these basic computer skills before graduation.

Some technology literacy competencies that may be relevant in some situations include: (1) knowing the basic operation, terminology, and maintenance of equipment, (2) knowing how to use computer-assisted instructional programs, (3) having knowledge of 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 in assuring all our children become proficient information and technology users. A teacher-supported scope and sequence of skills, well designed projects, and effective assessments are also critical. Equally essential is 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).

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Technology Skills for Information Problem Solving

A Curriculum Based on the Big6 Skills Approach

© Michael B. Eisenberg, Doug Johnson and Robert E. Berkowitz

1. Task Definition

The first part in the information problem-solving process involves recognizing that an information need exists, defining the problem, and identifying 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 groupware 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 groupware 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 groupware on the Internet and local area networks.
D. Define or refine the information problem using computerized graphic organization, brainstorming or idea generating software. This includes developing a research question or perspective on a topic.

2. Information Seeking Strategies

Once the information problem has been formulated, the student must consider all possible information sources and develop a plan for searching. Students will be able to:

A. Assess the value of various types of electronic resources for data gathering, including databases, CD-ROM resources, commercial and Internet online resources, electronic reference works, community and government information electronic resources.
B. Assess the need for and value of primary resources including interviews, surveys, experiments, and documents that are accessible through electronic means.
C. Identify and apply specific criteria for evaluating computerized electronic resources.
D. Identify and apply specific criteria for constructing 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 groupware 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 a computer to generate modifiable flow charts, time lines, organizational charts, project plans (such as Gantt charts), and calendars which will help the student plan and organize complex or group information problem-solving tasks.
G. Use handheld devices such as personal digital assistants (PDAs), electronic slates or tablet PCs to track contacts and create to-do lists and schedules.

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 computer resources and technologies available within the school library media center, including those on the library media center's local area network (e.g., online catalogs, periodical indexes, full-text sources, multimedia computer stations, CD-ROM stations, online terminals, scanners, digital cameras).
B. Locate and use appropriate computer resources and technologies available throughout the school including those available through intranets or local area networks (e.g., full-text resources, CD-ROMs, productivity software, scanners, digital cameras).
C. Locate and use appropriate computer resources and technologies available beyond the school through the Internet (e.g., newsgroups, listservs, WWW sites, ftp sites, online public access library catalogs, commercial databases and online services, and other community, academic, and government resources).
D. Know the roles and computer expertise of the people working in the school library media center and elsewhere who might provide information or assistance.
E. Use electronic reference materials (e.g., electronic encyclopedias, 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 computer 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 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, etc.) including the use of:
    1. Search tools and commands for stand-alone, CD-ROM, networked or Web-based online databases and services;
    2. Search tools and commands for searching the Internet, such as search engines, meta search tools, bots, directories, jump pages, and specialized resources such as those that search the Invisible Web;
    3. Specialized sites and search tool 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 computer technology 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 locations of those sources in order to properly cite and credit sources in footnotes, endnotes, and bibliographies.
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, rejecting information that is not relevant.
H. Save and backup data gathered to secure locations (floppy disk, personal hard drive space, RW-CD, online storage, flash memory, etc.)

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, applying keyboard skills equivalent to at least twice the rate of handwriting speed.
C. Create and use computer-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 electronic slide shows and to generate overhead transparencies and slides.
H. Create and use projection devices to show hypermedia and multimedia productions with digital video, audio and links to HTML documents or other programs. Convert presentations for display as Web pages.
I. Create Web pages and sites using hypertext markup language (HTML) in a text document or using Web page creation tools and know the procedure for having these pages loaded to a Web server.
J. Use e-mail, ftp, groupware, and other telecommunications capabilities to publish the results of the information problem-solving activity.
K. Use specialized computer applications as appropriate for specific tasks, e.g., music composition software, computer-assisted drawing and drafting programs, mathematics modeling software, scientific measurement instruments, etc.
L. Properly cite and credit electronic sources (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 (i.e., classmates, teachers, library media 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 spell and grammar checking capabilities of word processing and other software to edit and revise their work.
C. Apply legal principles and ethical conduct related to information technology related to 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 in relation to use of the Internet and other electronic technologies.
F. Use e-mail, real-time communications (e.g., listservs, newsgroups, instant messaging services, chat rooms, IP telephony) desktop teleconferencing, and groupware 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.

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).

This curriculum guide is an excerpt from the ERIC Digest (September 2002) entitled *Learning and Teaching Information Technology: Computer Skills in Context*, written by Michael B. Eisenberg and Doug Johnson.

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