Using authentic learning to teach basic technology skills

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Using authentic learning to teach basic technology skills

Abstract
During the past decade, most school districts have been required to write technology plans that have included the goal that students will become technologically literate. Teachers and administrators have been challenged to teach technology skills that will help student solve problems in the work place. What has been commonplace is for schools to offer courses or units in which students acquire skills without applying them to real world problems. This paper takes a look at the literature and research surrounding the use of technology, and the learning of technology skills, in the framework of authentic learning.

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USING AUTHENTIC LEARNING TO TEACH BASIC TECHNOLOGY SKILLS

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Abstract

During the past decade, most school districts have been required to write technology plans that have included the goal that students will become technologically literate. Teachers and administrators have been challenged to teach technology skills that will help student solve problems in the work place. What has been commonplace is for schools to offer courses or units in which students acquire skills without applying them to real world problems. This paper takes a look at the literature and research surrounding the use of technology, and the learning of technology skills, in the framework of authentic learning.
Introduction

The advent of affordable, reliable, and powerful computer technology has been accompanied by a host of educational innovations designed to make use of technology to enhance learning. Often teachers have been given computers and have been expected to use the technology with little or no guidance.

There seems to be clear and widespread agreement among the public and educators that students need to be proficient computer users—students need to be “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. (Eisenberg & Johnson, 1996, p.1)

Teachers and administrators are beginning to recognize 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.

Students may learn isolated skills and tools, but they will 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 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 “computer literacy” because they have genuinely applied various computer skills as part of the learning process. (Eisenberg & Johnson, 1996, p.1)
The concept of learning computer skills as needed to solve real world problems is backed by abundant research and is contained in many informational technology models that will be described in this paper.

Methodology

In researching the use of technology in authentic learning, the author utilized many valuable resources. There is an overwhelming amount of research on the use of technology in relation to authentic learning and authentic assessment. The University of Northern Iowa Rod Library and its website were good starting points for the research. One of the resources accessed through the Rod Library web site was the Educational Resources Information Center (ERIC) database. The Grant Wood Area Education Agency, located in Cedar Rapids, IA, had a large collection of professional materials available locally. The suggested readings and references found in these professional materials also lead to further information. The Grant Wood Area Education Agency also provided access to the EBSCO searchable online database of over 450 full text journals designed for professional educators Internet education sites like “Study Web” proved to be good places to search for relevant materials. Internet search engines found hundreds of web sites dealing with the phrases “authentic learning” and “technology skills”. One criterion for credible Internet pages was that information had to have cited references. References found on Internet sites were also deemed reliable if they were in the “.gov”, “.k12”, or “.edu” domains and contained a bibliography of resources. Information found on the U.S. Department of Education web site was also deemed to be of high quality and reliability. Most of the published articles and Internet pages that were accessed contained references to many of the same bodies of research. This added to the reliability and
credibility of the collected information. Published work that included references to research was deemed credible and worthy of reference in this paper.

Analysis and Discussion

Since the 1980's when personal computers were becoming prevalent in classrooms across the United States, school districts have been trying to figure out how to teach computer skills. The 1983 Nation at Risk report identified computer competency as a basic goal (Fulton, 1997). Computer literacy at that time was defined as understanding computers and their parts. Programming was emphasized because programming made computers useful. Churma (1999) found that students in the 1980's were using computers to write programs and completing activities that educators believed would foster logical thinking skills. “Students also learned word and data processing to prepare for careers in the increasingly technological world” (Churma, 1999, p. 9). Software such as drill and practice and simulations was also used. Today’s educators are integrating technology into learning activities in order to enhance lessons and increase achievement. Schools across the nation have been increasing the amount of computers and other technologies available to teachers and students. “Learning to use technology is a clear goal in K-12 education today, and schools worldwide are scrambling to add hardware, software, and connectivity and to infuse computer technology into the instructional program.” (Eisenberg, 2002, p.1). The U.S. Presidential initiative “No Child Left Behind” has among its national educational goals to teach children how to use the technological tools and to integrate that technology into the curriculum to improve student achievement (No Child Left Behind, 2002). Studies have shown that parents see technology skills as an essential part of a child’s education (Eisenberg, 2002). The 1991 Department of Labor SCANS report
identified technology skills as necessary for employment in the business community (Fulton, 1997).

In response to the educational opportunities made available by dramatic technological innovations in the early and mid-1990s, U.S. Secretary of Education released the nation's first educational technology plan in 1996, Getting America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge. This plan presented a far-reaching vision for the effective use of technology in elementary and secondary education to help the next generation of school children to be better educated and better prepared for the evolving demands of the new American economy. (U.S. Department of Education e-Learning, 1999, p.1)

The first national educational technology plan included a goal that all students will have technology and information literacy skills (U.S. Department of Education e-Learning, 1999) (see Appendix A for a summary of the National Educational Technology Goals). This goal encourages educators to connect technology literacy to standards.

To ensure that students are prepared for their future we should: include technology and information literacy in state and local standards for what students should know and be able to do; ensure students use technology appropriately and responsibly; develop new student assessment tools; and strengthen partnerships with industry to help meet the workforce needs of the future. (U.S. Department of Education e-Learning, 1999, p.2)

Students should be proficient information and technology users. Students need to have the skills to participate in our highly technological society. Perhaps with that in mind,
Johnson (1999) wrote that educators must consider what the basic computer skills are that all high school students should master before graduation. Where do these skills fall in the curriculum? How will these skills be taught and by whom? Johnson brings to the surface a question of whether a student who operates a computer well enough to play games can be considered computer literate. "Will a student who has used computers in school only for running tutorials or an integrated learning system have the skills necessary to survive in college or in the work place?" (Johnson, 1999, p. 81). Perhaps the student who has enough skills to play computer games can apply prior computer knowledge to new learning situations.

Is there a connection between technological literacy and achievement? Schacter (1999) summarized Sivin-Kachala's 1998 review of 219 research studies on the effect of technology on learning and achievement. Schacter found that students in technology rich environments experienced positive effects on achievement in all major subject areas. Schacter also found that students' attitudes toward learning improved when computers were used for instruction. Archer's study (as cited in Quinn & Valentine, 2002) looks at the link between technology and higher test scores.

What matters most are not the machines and the wiring themselves, but what teachers and students do with them... a constructivist approach toward learning, in which students work in rich environments of information and experience, often in groups, and build their own under-standings about them - taps into the computer's greatest strengths. (Quinn & Valentine, 2002, p. 4)

Eisenberg (2002) looks at what it means to be computer literate. First, educators are slowly becoming aware that students do not just need to learn how to operate
computers and specific pieces of software, but to be able to use a wide range of information technologies. Second, there needs to be a shift in the focus of teaching computers in an isolated class to the idea of students learning technology in a purposeful way as part of a subject area curriculum. Computer literacy in the 1980’s was defined as understanding computers and their parts (Fulton, 1997). The 1992 Computers in Education Study, conducted by the International Association for the Evaluation of Educational Achievement, defined computer literacy in terms of concepts, computer handling, and applications (Fulton). Programming was not part of the Functional Information Technology Test that was designed for the study.

Part of the resistance to integrating computer literacy education in the curriculum is that teachers don’t feel they have adequate skills and knowledge. “Time and again, the research comes back to the teacher as the most influential component of a successful technology program.” (Quinn & Valentine, 2002, p. 4). The classroom teacher must have training with integrating technology. The wall that has separated the computer skills curriculum and the other curricular areas needs to be broken down to allow for more meaningful technology learning. No longer can the computer be held in reserve for specific computer classes. Computers and other technology must be made available to all students to be used as a tool for learning.

When technology is used as a tool for accomplishing complex tasks, the issue of mismatch between technology content and curriculum disappears altogether. Technological tools can be used to organize and present any kind of information. Moreover, it is not necessary for the teacher to know everything about the tools that students use; students and teachers can acquire whatever technology skills
they need for specific projects. In fact, one of the best things that teachers can do with respect to technology is to model what to do when one doesn't know what to do. (Means & Olson, 1994, p. 1)

When computers were first introduced into the classroom, teachers were typically given the task of using them with little or no training. The appeal of the microcomputer and their expense dictated that they be used, but there was often little connection with the curriculum.

Now, we've entered an era in which technology is no longer an intimidating novelty. Its use in business and industry is both accepted and expected. And pressure abounds — from the federal government, from local school boards, and certainly from the popular press — for educators to get on board and see to it that students become technologically skilled. (Schrum, 2000, p. 1)

In 1997, National Educational Technology Standards for Students were developed in the International Society for Technology in Education NETS project (ISTE, 1997a). These educational technology standards state that students must understand technology systems and be proficient in the use of technology. Using technology productivity tools to enhance learning and to increase productivity is another part of the national standards (see Appendix B for an overview of the student NETS). Students must learn to use technology tools for communication, research, problem solving, and decision-making.

Technology standards, National Educational Technology Standards for Teachers, were also developed for teachers (ISTE, 1997b). Although all of these standards relate to student achievement, two standards in particular relate to student use of technology. The first is that teachers are to plan and design effective learning environments and
experiences supported by technology. The second is that teachers are to implement technology-rich experiences and environments that address subject matter content and student technology standards while developing learning communities. These two standards reinforce the idea that technology is a part of the overall educational experience and not an isolated course or curriculum (see Appendix C for the ISTE National Educational Technology Standards for Teachers).

Students need to learn to use technology tools as an everyday aid to completing projects. Fulton (1999) cited a 1997 study of high school graduates participating in the Scholastic Achievement Test program. This study found that only nine percent reported that they had not used computers in high school coursework. This was an improvement from a similar survey taken in 1987 where 26 percent of the students had not used computers in high school. The same surveys showed a drop in computer programming from 44 to 24 percent. This would indicate that schools are de-emphasizing computer programming courses in favor of the integrated use of computers across the curriculum.

There is a growing movement for students to become computer literate by using technology in the context of meaningful curriculum activities. Technology advances, along with the affordability of computers, have made a significant impact on education.

“Control of the traditional curriculum is going, going, gone. Teachers, departments, schools, and school districts can no longer control curricula as they have in the past. With the growth of technology, the teaching of specific, prescribed courses of study that are textbook driven and that are based on course outlines sitting on administrators’ shelves with a concomitant emphasis on content
and information is no longer viable.” (Melchior, Gawith, Edwards, & Keany, 1997, pp. 91-92)

Thirty years ago high school technology courses were typically offered as elective courses through the business education department. Back in those ancient times the courses might have been known as typing, accounting, and photography. Johnson (1999) asserted that productivity tools such as word processors, databases, and graphics are similarly taught only in special business or technology classes taken by a minority of students. These productivity applications can benefit all students and need to be integrated into all aspects of the school curricula.

Technology has changed the way we might solve problems, but the problems themselves do not change much over decades. The thought processes and not the specific skills are key to a sound education. Students who become proficient in using very specific technologies during their school days may not be able to easily transfer that knowledge to new technologies found in their workplace.

The last quarter-century has seen many jobs and workplaces transformed by technology, and the rate of change shows no sign of slowing. Succeeding in this environment will mean that workers need a firm foundation in basic skills, the sophistication and focus to work productively in new workplace cultures, and the ability to learn new skills and master new technologies throughout their careers. (Giddens & Stasz, 1999, p. 18)

With the constantly evolving nature of technology, it would be naïve to believe that specific computer skills taught to students would be sufficient to prepare them to immediately step into the workplace.
Moving from teaching isolated computer skills to helping students learn integrated information and technology skills is not just a good idea—it’s essential if we are to put students in a position to succeed in an increasingly complex and changing world. (Eisenberg & Berkowitz, 2000, p. 30)

It is, therefore, responsible teaching to prepare students to think critically when choosing technology tools and to transfer knowledge to new technological environments. Instead of learning specific technology skills in a computer class, students should use technology authentically.

Key concepts in authentic uses of technology are: 1) The technology supports student performance of an authentic task, 2) The technology use is integrated into activities that are a core part of the classroom curriculum, and 3) Technology is treated as a tool to help accomplish a complex task rather than a subject of study for its own sake. (U.S. Department of Education, 2000, p.1)

There is a growing amount of research on teaching and learning technology skills that are integrated into the curriculum.

The main arguments for integrated curricula or interdisciplinary studies as they are sometimes called, are threefold: (a) the knowledge explosion is very real and there is simply too much information to be covered in the curriculum; (b) most school subjects are taught in isolation, and students never are able to make the connections; and (c) curriculum integration is designed around problems and concerns students have about themselves and their world. (Ellis, 2001, p. 167)

According to Ellis, the current curriculum is obsolete and does not address the needs, interests, and capacities of today’s students. When utilizing an integrated curriculum,
students see meaningful relationships because the subject matter is a vehicle for learning. Curriculum integration represents a philosophy of student-centered learning. "The inclusion of a comprehensive list of computer skills in an information literacy curriculum creates a model for a computer literacy curriculum, and eliminates the need for a separate computer curriculum." (Johnson, 1999, p. 81). Eisenberg (2002) echoed this concept of teaching computer skills as an integrated part of the curriculum:

Helping students learn to apply technology in these ways requires a change in the way computer skills are traditionally taught in school. It means moving from teaching isolated "computer skills" to teaching integrated "information and technology skills." Integration means infusing technology in the curriculum. (p.1)

Melchior, Gawith, Edwards, and Keany (1997) found that new technologies are driving major changes in schools. Traditional teaching practices are being challenged by the advent of these new technologies. Learning is increasingly using technology both in schools and in homes.

The focus is no longer on students' learning by being immersed in what educational technology can provide but rather on students' developing information literacy, which is directly related to processes, such as how student find, use, select, reject, and interpret information critically. (Melchior et al., 1997, p. 90)

In the U.S. Department of Education's report "Technology and Education Reform" (U.S. Department of Education, 2000), a call was made for students to learn to use needed technology skills by performing authentic tasks:
Giving students experiences in selecting appropriate technology tools and in applying technologies such as word processors, spreadsheets, hypermedia, and network search tools to their work supports the performance of complex, authentic tasks and provides experiences that prepare students for the world outside of school. We call these uses of technology authentic because students are using them for the same kinds of purposes and in the same ways that adults would use technology outside the school walls. (U.S. Department of Education, 2000, p.1)

The report called for authentic tasks that mirror how adult society members utilize technology. Many schools in the previous century followed a factory-like organization (Fulton, 1997). Today, schools are again looking toward businesses for input into the skills they feel students should have when entering the workforce. “Authentic learning and alternative assessment strategies will facilitate the type of learning that is needed by employees to allow the United States to compete internationally” (Ellis, 2001, p. 236). This is changing the way technology literacy is taught.

New views of cognition support a constructivist view that does not dispute the importance of learning basic skills but holds that “advanced skills of comprehension, reasoning, composition, and experimentation are acquired not through the transmission of facts but through the learner’s interaction with content.” (Fulton, 1997, p. 23)

Authentic learning is essential in preparing students to function successfully in the technological world in which they live. Zemelman, Daniels, and Hyde (as cited in Ellis, 2001), identified thirteen interlocking principles, assumptions, or theories that
characterize best practice for teaching and learning. Among these best practice principles is the need for learning to be authentic. During the course of authentic learning, students are engaged in authentic tasks. “Authentic tasks enable students to make sense of and apply what they have learned and to establish clear connections between what they have learning in schools and the world in which they live.” (Martin-Kniep, 2000, p. 26).

Authentic tasks must have real purpose. There must be integration of content and skills that require disciplined inquiry and academic rigor. Authentic tasks are connected to explicit standards and scoring criteria. Students involved in an authentic task use elaborate communication and exhibit higher-order thinking. There is reflection, self-assessment, peer-assessment, and feedback. Authentic tasks cover a wide range of content, utilize multiple strategies, result in products, and typically take up more time than traditional learning tasks (Martin-Kniep, 2000).

Langer and Applebee’s (as cited in Jalongo, 1991) extensive review of research on learning identified five features of authentic learning experiences—ownership, appropriateness, structure, collaboration, and internalization. The first feature, ownership, refers to both children and teachers who assume greater responsibility for their own learning. The second feature, appropriateness, finds that learning activities are appropriately shaped to the needs of the learners. Third, there are structures and routines, but they are not rigid. The structure is shaped more to reflect the environment and organization of activities than on predetermined responses from students. The fourth structure is collaboration. Students work in flexible groups, same-age and cross-age groups, small and large groups, and in very large community groups. The last feature is internalization of what is learned. Authentic learning involves students so that they
internalize what they have learned. Newmann & Wehlage (1993) articulated five standards of authentic instruction: higher-order thinking, depth of knowledge, and connectedness to the world beyond the classroom, substantive conversation, and social support for student achievement. These standards are used to assess the extent to which a given activity engages students in using their minds. In addition to formal standards, assessment is concerned with the everyday life problems students encounter. “An assessment is authentic when it requires that students engage with real-life problems, issues, or tasks for an audience who cares about or has a stake in what students learn.” (Martin-Kniep, 2000, p. 26).

The increase of networking and high speed Internet access has brought an influx of information into the classroom. With this influx has come the need to expand definitions of technology literacy to include finding, validating, and using information.

The days when teachers and parents were able to control and orchestrate all the information presented to students is gone. The technology of the Internet will force the development of broader information literacy skills for students if we expect them to sort the wheat from the chaff, the true from the untrue, the rumor from the real. In order to work, learn, and flourish in what has been called the infosphere, students will need to become skilled in: 1) Finding information from a variety of sources, 2) Evaluating information, making critical judgments about the information’s value, reliability and validity, and 3) Creating and distributing information and knowledge via the many communication forms—text, video, graphics, conversation—that come together in today’s technology-mediated communication formats. (Fulton, 1997, p.19)
Using technology to locate and access information helps students become more technological literate and information literate. There is a great link between technology and information in the educational process. "Two types of literacy are required: technological literacy and information literacy. The former is learning to operate the machine; the latter is learning to use and interpret the information to which the machines provide access." (Melchior, Gawith, Edwards, & Keany, 1997, p. 90).

One innovation in education that addresses the need to teach informational literacy skills is the Big6™, developed by Eisenberg and Berkowitz (2000)(see Appendix D for a summary of the Big6™). "The Big6™ is a process model of how people of all ages solve an information problem." (Eisenberg & Berkowitz, 2000, p.5). The nature of our world today is a problem in that there is so much "stuff" out there that it is not easy to keep up. One solution to the information problem is to speed things up. Schools try to pack in more and more content and work faster to get more done. Eisenberg & Berkowitz suggest a solution is to help students work smarter, not faster. The Big6™ can be applied to school, personal, and work settings and is applicable to all subject areas and across the full range of grade levels. Because the Big6™ skills are best learned when integrated with classroom curriculum and activities, it is a natural fit with learning technology skills.

Being computer literate is more than simply being able to operate a computer. First, there is recognition that it's not just computers that we want students to be able to use. We want them to be literate in using the full range of information technologies—productivity tools, communications capabilities, information resources and systems, hand-held devices, and more. Second, the focus is shifting from "teaching computing in a separate class located in a computer lab" to
“students learning to use the full range of information technology for a purpose as part of the subject area curriculum.” (Eisenberg & Berkowitz, 2000, p. 29)

Teaching technology skills authentically has an advantage of flexibility. (U.S. Department of Education, 2000). Technology applications can be used as tools to support any curriculum. Teaching technology in isolation does not match with state and national curricular goals and standards. Authentic learning also has the advantage of being meaningful and relevant. “With authentic experiences, students are not storing their learning to be used “later,” but instead are involved in stuff that has meaning for them now.” (Daniels & Bizar, 1998, p. 171). Authentic learning not only helps motivate students, but also engages them in higher-order thinking. “Authentic tasks are more likely to motivate students to undertake and continue the work that real learning requires. Students are more likely to use the real-world knowledge and the skills of higher-order thinking and problem-solving that authentic achievement engenders” (Keef & Jenkins, 1997, p. 57).

Conclusion and Recommendations

In the past few decades, there has been a great influx of technology in our everyday lives. Technology use is common in the workplace and in the home. Schools have become connected to the Internet and students are able to access more information than they are able to process. Schools have been charged with preparing students to be productive members of society, which includes having the ability to use technology tools and process information to solve problems. While schools have relied on computer software such as tutorials, drill and practice, and simulations to teach concepts and reinforce skills, there is a clear movement in present times to a more integrated approach
to using technology. It is no longer sufficient for students to learn programming or computer skills independent of the total school curriculum. Students must be proficient in utilizing technology and adapting to changes in technology tools. Students must be lifelong learners with the ability to learn new skills and master new technologies.

Helping students become lifelong learners requires teachers to model using technology. In order for technology to make a lasting impact, teachers need to employ a variety of teaching and learning approaches that integrate technology. In a technology-rich classroom, the focus is on learning with appropriate technology. The focus is not on learning technology. Technology merely provides the tools to be used for authentic learning. It is a means, not an end. Teachers must use the computers that have been placed in their rooms to demonstrate that technological tools will help achieve goals. To effectively integrate technology into the curriculum, teachers need to have access to technologies, acquire basic technology skills, and have technology support.

Research supports the positive impact of integrating technology in the curriculum on student achievement. The “No Child Left Behind” initiative calls for technology to be integrated into the curriculum. National technology standards call for the integration of technology in all of learning. The International Society for Technology in Education has established goals for students and teachers. The U. S. Department of Education and the U. S. Department of Labor have released reports stressing the need for students to be proficient information and technology users. Educators need to prepare students to critically choose and use technology tools. Students must enter the workforce with the ability to acquire and use new technology skills and to adapt to new technologies.
The connection has been made linking technology literacy and student achievement. Being technology literate is not limited to knowing how to operate a computer or a specific piece of software. Students need to be able to use technology as part of the problem-solving process. Being able to choose the right tools to locate and access information to solve problems is a key to being technology literate. Students should be literate in using all information technologies and need to obtain technology skills as part of the subject area curriculum. Using technology should not be limited to a computer course. Technology must be fully integrated into a curriculum that is designed around solving real world problems. Students must be given authentic tasks in which they apply technology tools for the same kinds of purposes as they would outside of school. Authentic learning is essential in fostering lifelong learning. Authentic tasks provide meaning and establish connections to what students are learning. Authentic learning deeply engages students in their learning. Authentic instruction involves higher-order thinking and requires students to engage with real world problems, issues, and tasks.

Access to the World Wide Web, faster computers, and multimedia software has helped teachers integrate technology in the subject area curricula. Students are able to access staggering amounts of information in a short amount of time. While students learn to use technology as part of an integrated approach, they need to develop information technology skills. The Big6™ is one innovation in education that addresses information literacy. This model for locating, accessing, and using information goes hand in hand with learning technology skills. Students not only should be able to use technology effectively, but also efficiently. They must be able to determine appropriate technology tools to use in solving problems.
Authentic tasks are meaningful and more likely to motivate students to fully engage in learning activities. Authentic learning is grounded in standards. Educators can use advances in technology to fully integrate technology into a student-centered curriculum. The future may see fewer computer labs dedicated to teaching isolated computer skills, and more labs dedicated to facilitating the learning process through the integration of technology in the curriculum. The ability to acquire and appropriately use technology skills is essential to lifelong learning. The best way for educators to produce technological literate students is to provide them with authentic technology-based learning tasks.
References


Appendix A

NATIONAL EDUCATIONAL TECHNOLOGY GOALS

Goal 1: All students and teachers will have access to information technology in their classrooms, schools, communities and homes.

An integral part of school improvement and reform efforts in the 21st century, in the United States and abroad, will be student and teacher access to educational technology, such as computers connected to the Internet. Universal access to the Internet will help end the isolation of teachers; exponentially expand the resources for teaching and learning in schools and classrooms; provide more challenging, authentic and higher-order learning experiences for students; and make schools and teachers more accountable to parents and communities.

The quality of Internet access is critical. Broadband access will be the new standard. Slow, unreliable connections that cannot support interactivity or rich multimedia content will no longer be sufficient. To take advantage of access to technology for improved teaching and learning, it will become increasingly important to build and support network infrastructures-wired or wireless, desktop or handheld—that allow multiple devices to connect simultaneously to the Internet throughout every school building and community in the nation.

To realize the goal of universal access to educational technology for students and teachers, we should ensure sustained and predictable funding for technology; ensure that technology plans reflect the educational needs of students and are regularly updated; improve the affordability, reliability and ease of use of educational technology; ensure that school buildings and facilities are modern; strengthen our commitment to eliminating the digital divide; and ensure that all students have equal opportunities to access and use technology.

Goal 2: All teachers will use technology effectively to help students achieve high academic standards.

Most teachers have been prepared for a model of teaching dramatically out of step with what is needed to prepare the nation's students for the challenges they will face in the future. Recent reports by the American Council on Education, the CEO Forum on Education and Technology, the Milken Exchange on Education Technology, the National Commission on Mathematics and Science Teaching for the 21st Century, and the National Council for Accreditation of Teacher Education, among others, all identify opportunities to enhance teacher quality and teacher preparation, particularly as they relate to the effective use of technology in education.

Ensuring that the nation has effective 21st-century teachers requires more than just providing sufficient access to technology for teaching and learning. We should improve the preparation of new teachers, including their knowledge of how to use technology for effective teaching and learning; increase the quantity, quality and coherence of
technology-focused activities aimed at the professional development of teachers; and, improve the instructional support available to teachers who use technology.

Goal 3: All students will have technology and information literacy skills.

The need to prepare students with the skills they need to participate fully in our increasingly technological society has become a major priority for the nation. A meaningful, unified approach to providing students with the skills they will need for their futures must be more than a checklist of isolated technology skills; rather, these skills are only a first step in assuring all our children become proficient information and technology users.

Also necessary are information problem-solving skills, such as how to define tasks, identify information seeking strategies, locate and access information, determine information's relevance, organize and communicate the results of the information problem-solving effort and evaluate the effectiveness and efficiency of the solution. The call for this new "21st-century literacy" in no way supplants current efforts by states and districts to set and even raise academic standards for students; it simply reflects the fact that the bar for an educated citizenry and workforce continues to rise to reflect changes in society.

In requiring these skills of students, we will ensure that the opportunities made possible through the use of technology will be available to all students as they progress through school, regardless of personal or socioeconomic factors. Even for those students who do not pursue technology careers, ensuring technology and information literacy skills will provide a number of benefits.

To ensure that students are prepared for their future we should: include technology and information literacy in state and local standards for what students should know and be able to do; ensure students use technology appropriately and responsibly; develop new student assessment tools; and strengthen partnerships with industry to help meet the workforce needs of the future.

Goal 4: Research and evaluation will improve the next generation of technology applications for teaching and learning.

At the dawn of the 21st century, we are still at the beginnings of a technological revolution that is bringing dramatic changes to our society. This technological revolution will not automatically translate into a similar revolution in teaching and learning. While we have learned a tremendous amount about the implementation and use of technologies for teaching and learning in the past few years, the need for an expanded, ongoing national research and evaluation program to improve the next generation of technology applications for teaching and learning is profound.

To implement such a program requires a sustained, multi-disciplinary collaboration of learning scientists, technologists, and subject-matter experts. Numerous organizations have pointed out the urgency of this national need, including the President's Committee of Advisors on Science and Technology, the U.S. Department of Education, the National
Science Foundation, the National Research Council, private charitable foundations, independent research institutes and representatives of academia.

To ensure that research and evaluation will improve the next generation of technology applications for teaching and learning, we should: initiate a systematic agenda of research and evaluation on technology applications for teaching and learning; encourage state and local evaluations of technology programs; and support the dissemination and use of research-based information to improve teaching and learning.

Goal 5: Digital content and networked applications will transform teaching and learning.

Digital content and networked applications will support transformative changes in our approaches to teaching and learning. In order for these changes to lead to increased educational opportunities for all students, digital content and networked applications must be independently judged to be of high quality (both in terms of grounding in learning science and pedagogical effectiveness), well-documented, comprehensive and available for all grades and subject areas, and have the power to inspire or motivate students. In addition, they must be easy to find and access, easy for students and teachers to use, and accessible to people with disabilities.

Today, there exists tremendous opportunities for the creation of powerful digital content and networked applications. For instance, digital content and networked applications offer direct opportunities to enhance learning by helping students to comprehend difficult-to-understand concepts; helping students to engage in learning; providing students with access to information and resources; and better meeting students' individual needs. In addition, technology applications can increase parental involvement and improve the accountability and efficiency of school administration.

To ensure that digital content and networked applications will transform teaching and learning, we should: ensure administrators and policymakers are technologically literate; support efforts to increase our understanding of how to improve teaching and learning through partnerships within and across sectors; identify leadership opportunities provided by technology to offer better ways of accomplishing educational goals; continue and expand efforts to digitize rich educational materials consistent with copyright laws; encourage the aggregation of demand for resources and services to attract better and more effective technology-based services for teaching and learning; support educators and technologists in defining what digital content and networked applications should be available to support teaching and learning; remove barriers to purchasing digital content and networked applications; recognize developers of high-quality digital content and networked applications and exemplary adoption of educational technologies; and support the integration of digital content and networked applications into state and local standards and curricular frameworks.

Source:

Appendix B

National Educational Technology Standards

ISTE's National Educational Technology Standards (NETS) reflect the collective research and analysis of a large number of IT education researchers and practitioners. The NETS document divides the educational technology standards into six broad domains.

Domain 1. Basic operations and concepts:
- Students demonstrate a sound understanding of the nature and operation of technology systems.
- Students are proficient in the use of technology.

Domain 2. Social, ethical and human issues:
- Students understand ethical, cultural, and societal issues related to technology.
- Students practice responsible use of technology systems, information, and software.
- Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity.

Domain 3. Technology productivity tools:
- Students use technology tools to enhance learning, increase productivity, and promote creativity.
- Students use productivity tools to collaborate in constructing models, preparing publications, and producing other creative works.

Domain 4. Technology tools for communication:
- Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.
- Students use a variety of media and formats to communicate information and ideas effectively to multiple audiences.

Domain 5. Technology tools for research:
- Students use technology to locate, evaluate, and collect information from a variety of sources.
- Students use technology tools to process data and report results.
- Students evaluate and select new information resources and technological innovations based on the appropriateness to the specific tasks.

Domain 6. Technology tools for problem solving and decision making:
- Students use technology resources for solving problems and making informed decisions.
- Students employ technology in the development of sophisticated strategies for solving problems in the real world.

Source:
Appendix C

PRIVATE Technology Standards for Teachers

National Educational Technology Standards (NETS)

   - Teachers will develop introductory information and technology literacy knowledge and skills (described in the ISTE National Educational Technology Standards for Students).
   - Extend information and educational technology skills and knowledge to increase learning and productivity.

2. Plan and Design Learning Environments and Experiences.
   Teachers plan and design effective learning environments and experiences supported by technology. Teachers will:
   - design developmentally appropriate learning opportunities matching effective instructional strategies and technology use with the diverse needs of learners (including use of assistive devices).
   - know about and apply current research on teaching and learning with technology when planning learning environments and experiences.
   - identify, organize, and manage, technology resources based on student needs and specific tasks.
   - locate and critically evaluate technology tools and information resources for accuracy and suitability for purpose.

3. Teaching, Learning and the Curriculum.
   Teachers implement plans, methods and strategies for using technology to maximize student learning. Teachers will:
   - implement technology-rich experiences and environments that address subject matter content and student technology standards while developing learning communities.
   - use technology to support the implementation of effective teaching and learning strategies for addressing the diverse needs of learners.
   - use knowledge about student motivation and behavior to encourage purposeful, on-task student engagement in learning positive social interaction and self-directed learning using technology.
   - use technology to develop higher order and complex thinking skills including problem solving, critical thinking, informed decision-making, knowledge construction, and creativity.

4. Assessment and Evaluation.
   Teachers understand how to assess student learning and apply technology to facilitate a variety of assessment and evaluation strategies. Teachers will:
   - use technology to assess student learning of subject matter using a variety of current research-based assessment techniques.
• use technology resources to collect and analyze data to inform instructional planning and lesson modification.
• evaluate the appropriate and effective use of technology resources by students as tools for learning.
• use technology tools to capture, represent, understand, and communicate assessment data.

5. Personal Productivity and Professional Practice.

Teachers develop knowledge, skills, and attitudes preparing them to apply technology for enhancing their own professional growth and productivity. Teachers will:

• engage in ongoing professional development and growth using appropriate technology resources.
• continually evaluate and reflect on professional practice regarding the use of technology in support of student learning.
• exhibit positive attitudes toward technology uses that support lifelong learning, collaboration, informed decision-making, and productivity.
• use technology to foster relationships with peers, parents, and the larger community to support professional growth and nurture student learning.

6. Social, Ethical and Human Issues.

Teachers understand the social, ethical, and human issues surrounding the use of technology in K-12 schools and apply those principles in practice. Teachers will:

• model and teach legal and ethical practice related to technology use
• address social and cultural diversity when identifying and using technology resources
• address health and safety issues related to the use of technology

Source:

Appendix D

What is the Big6™?

The Big6™ is the product of Mike Eisenberg and Bob Berkowitz. You can find their website at http://big6.com/. The Big6™ skills provide a systematic approach to information problem-solving that relies upon critical thinking skills. The Big6™ skills can be used by librarians, teachers and information specialists to help learners attain information literacy and provide a full understanding beyond merely being able to locate resources within a library. Basically, it involves:

- a systematic approach to information problem-solving
- six broad skill areas necessary for successful information problem-solving
- a complete library and information skill curriculum

How is it different?

Big6™ skills link information problem-solving and critical thinking. Simply knowing that the World Book Encyclopedia exists involves a low-level of cognition. Incorporating knowledge and the use of this encyclopedia within an overall problem-solving strategy represents a higher level of cognitive learning. Traditional library skills focus on knowledge and understanding of specific sources (lower cognitive skills) versus the ability to use critical thinking skills and manipulate information into a meaningful solution.

So, tell me the steps already!

- Task Definition
- Information Seeking Strategies
- Location and Access
- Use of Information
- Synthesis
- Evaluation

Task Definition

In this step, the student determines exactly what the information problem is and the specific information related to the problem. Using a simple school assignment as an example, students would need to know which questions need to be answered, what kind of information is needed to answer these questions, when it is due, etc. (Gosh, isn't it easier when teachers hand out the assignment so students can bring it with them to the library? hint, hint)

Information Seeking Strategies

Once the problem is clearly articulated, attention turns to the range of possible information sources. Information Seeking Strategies involves making decisions and selecting sources appropriate to the defined task. As librarians, we do this every time we assist a patron locate materials. We determine the depth of information needed, the reading level, possible related materials, and so on. Too many times students don't spend enough time thinking about these two steps. They leap right into step 3, Location and Access. This is becoming even more true as the Internet proliferates and students start surfing without the necessary forethought.
Location and Access
This is where the information seeking strategy really begins. Once students have decided on the appropriate strategy, the strategy must be carried out. This is the physical part and receives the most attention in traditional library curricula. Examples include: use of access tools, arrangement of materials, parts of a book, and strategies for searching an online catalog. Too often library instruction focuses on the use of particular skills associated with specific access tools such as the Reader's Guide to Periodical Literature, the catalog, etc.; rather than focusing on skills that can be transferred to other situations or other kinds of problems. In the Big6TM approach, getting to materials follows logically after deciding what it is you wish to find and where you might find it.

Use of Information
Once students are able to locate and access a source, they must be able to read, view, listen or interact with the information and decide what is valuable for their particular situation. They must extract the information that they need using notes, copies, citations, etc.

Synthesis
Synthesis is the restructuring or repackaging of information into new or different formats to meet the requirements of the task. Synthesis can be as simple as relaying a specific fact. Synthesis can be very complex involving several sources, a variety of media or presentation formats, and the effective communication of abstract ideas. This is where the real learning takes place as new information is brought in and links are made to pre-existing knowledge within the learner's head.

Evaluation
Evaluation determines how effectively and efficiently the information problem-solving process was conducted. The primary concern of evaluation are these questions:

- Was the information problem solved?
- Was the information need met?
- Was the decision made?
- Was the situation resolved?
- Does the product satisfy the requirements as originally defined?

Other considerations in evaluating the efficiency of the information solving process include the amount of time spent on useful activities and whether there was any miscalculation in the amount of time needed to complete the tasks. This "de-briefing" by the student, whether conducted mentally or formally in the classroom, will improve their overall ability to solve future information problems and is an important part of learning. It is always useful to have an evaluation checklist provided by the teacher so that students will know what criteria will be used to grade their work and how long each major task should take.

Source: