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ABSTRACT

This paper proposes a set of cumulative standards for assessing the uses of nonprint media and electronic technologies in elementary, middle, and high school classrooms. The proposed standards, culled from existing standards created for educational technologies, information literacy, and the English language arts, are offered as a guide and starting point for expanding notions of literacy and literacy learning in the schools. Most importantly from this perspective, the standards are categorized to address three types of literacies--basic, critical, and constructive--to encourage teachers to incorporate all three kinds of literacies when integrating technology use in teaching and learning across the curriculum. Contains 20 references. (Author/NKA)

CELA RESEARCH REPORT

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KAREN SWAN

CELA RESEARCH REPORT NUMBER 12013

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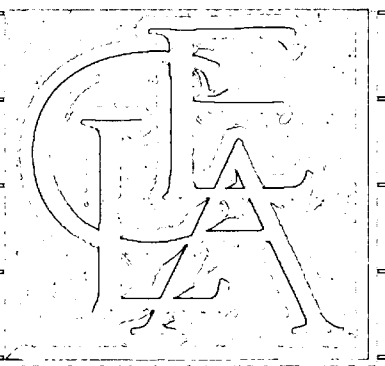

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NONPRINT MEDIA AND TECHNOLOGY LITERACY STANDARDS FOR K-12 TEACHING AND LEARNING

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The Center, established in 1987, initially focused on the teaching and learning of literature. In March 1996, the Center expanded its focus to include the teaching and learning of English, both as a subject in its own right and as it is learned in other content areas. CELA's work is sponsored by the Office of Educational Research and Improvement (OERI), U.S. Department of Education, as part of the National Institute on Student Achievement, Curriculum, and Assessment.

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ABSTRACT

This paper proposes a set of cumulative standards for assessing the use of nonprint media and electronic technologies in elementary, middle, and high school classrooms. The proposed standards are culled from existing standards created for educational technologies, information literacy, and the English language arts. They are offered as a guide and starting point for expanding our notions of literacy and literacy learning in the schools. Most importantly from this perspective, the standards are categorized to address three types of literacies – basic, critical, and constructive – to encourage teachers to incorporate all three kinds of literacies when integrating technology use in teaching and learning across the curriculum.

> The archdeacon pondered the giant edifice for a few moments in silence, then with a sigh he stretched his right hand toward the printed book that lay open on his table and his left hand toward Notre Dame and turned a sad eye from the book to the church.
>
> "Alas!" he said, "This will destroy that."
>
> — Victor Hugo, *Notre-Dame de Paris*

For the past several centuries, the dominance of print over other communications media has been overwhelming and largely unchallenged. Recent decades, however, have witnessed rapid changes in how we communicate, entertain ourselves, conduct business, get information, create knowledge, and generally make sense of the larger world. Electronic texts are everywhere replacing printed ones as the media of choice in a wide range of human endeavors. Our notions of what it means to be literate are, or should be, correspondingly expanding.

For example, the national standards for the English Language Arts state:

> . . . being literate in contemporary society means being active, critical, and creative users of print and spoken language, **as well as the visual language of film and television, commercial and political advertising, and more. It also means being able to use an array of technologies to gather information and communicate with others** [emphasis added] (National Council of Teachers of English/International Reading Association, 1996b, p. 2)

JoAnn Gora, provost at Old Dominion University, introduced that university's tough new computer literacy policy by stating, "Knowledge of computers is critical to being able to function well in the 21st century. It's just as important as an understanding of the English language." Renee Hobbs argues for a new definition of literacy based on the work of media educators. "Literacy," she writes, "is the ability to access, analyze, evaluate, and communicate messages in **a variety of forms**" [emphasis added] (Hobbs, 1998, p. 7).

Indeed, as we find ourselves on the eve of a new millennium, the question of whether or not we should be using new media technologies in our nation's classrooms has changed, at least at the policy making level, into that of how we can best integrate their use across the curriculum. The President's Panel on Educational Technology, for example, contends:

> The probability that elementary and secondary education will prove to be the one information-based industry in which computer technology does not have a natural role would at this point appear to be so low as to render unconscionably wasteful any research that might be designed to answer this question (Panel on Educational Technology, 1997, pp. 93-94).

Unfortunately, at a local level, educators tend to be less enlightened. Numbers reports (Becker, 1994, 1999; Educational Testing Service, 1998; Panel on Educational Technology, 1997) have documented the low level uses being made of computers and other electronic media in most American schools.

In a series of focus groups and interviews conducted with teachers, students, and ordinary people, and designed to explore notions and beliefs about literacy and electronic media, we found that most participants equated literacy with printed texts, and that this tendency was more pronounced the closer we came to the classroom (Swan, Meskill, Bowman, & Mossop, et al., 1997). Teachers and students equated literacy with reading and writing (printed texts) and were quite stubborn in their refusal to accept electronic works as literature.

Teachers were also more likely to hold skills-based (as opposed to critical and/or creative) concepts of literacy and electronic literacy. On the other hand, teachers' logs of their own media use indicated that most of them got the majority of their news and information from electronic sources (Swan, et al, 1997). Thus, we uncovered a big gap between what teachers actually "read" and what they believe constitutes literacy, especially literacy as it should be taught in schools.

People's notions of literacy are historically, culturally, and socially determined and are grounded in the materials used for communication (Bolter, 1991; Haas, 1996; Snyder, 1998). In the Middle Ages, common people could not read or write, but they could "read" the graphics of illuminated Bibles or the icons featured in carvings and stained glass windows in the great cathedrals. In this paper's opening quotation, Victor Hugo's archdeacon foresees the coming of widespread print literacy and laments the result: the church's loss of one of its primary means of communication. We are at a similar historical crossroads today (Snyder, 1998; Stephens, 1998). Those of us who love the written word understandably lament its decline. But if we care about literacy in a larger sense, we must address nonprint literacies, especially those involving electronic media. Ilana Snyder writes:

> . . . as literacy educators we must consider ways in which the new technologies might be employed for useful purposes in literacy education at all levels. Just because we have remained largely impervious to technological change does not mean that this is how we should continue to respond. Even more important, if we are to begin to bridge the growing gulf between ourselves and our students, we cannot afford to remain ignorant of the characteristics of these new technologies and their complex cultural influences (1998, p. xxiii).

Teachers' and students' skills-based notions of literacy need to be expanded to include being active, critical, and creative users of a variety of media. Nonprint media need to be integrated across the curriculum and their literate use valued in the classroom. This paper is directed to teachers and administrators and is meant to serve as a way of opening a practical dialog concerning how an expanded notion of literacy might be operationalized in schools.

This paper also explores the notion that technology integration across the curriculum is the desired outcome of current K-12 technology initiatives, such as the President's Technology Learning and Technology Literacy Challenges (Executive Office of the President, 1996). Technology integration across subject areas and grade levels can best be measured in terms of the critical and creative uses made of nonprint media and computing and communications

technologies. To such ends, this paper presents a possible set of performance-based, nonprint media and technology literacy competencies to be used as standards for guiding and assessing expanded concepts of literacy and technology integration across the K-12 curriculum.

The work presented in this paper was undertaken by the Technology and Literate Thinking Research Strand of the National Research Center on English Learning & Achievement (CELA). CELA is dedicated to improving the teaching and learning of the English language arts and focuses on the literacy necessary to write about, talk about, and extract meaning from knowledge and experience. CELA's Technology and Literate Thinking group is concerned with the role of technology in achieving such literacy. Its research focuses on two interrelated questions:

- What new forms of literacy and literate thinking are occasioned by electronic media and how are these correspondent and/or incongruent with school beliefs concerning language and literacy development?
- By what processes do people develop literate thinking through interaction with electronic texts, and how can these processes be shaped by educators to maximize such development?

THE PANEL ON EDUCATIONAL TECHNOLOGY

The Panel on Educational Technology was organized in 1995 to provide independent advice to the President on the application of a variety of technologies, telecommunications and computing in particular, in K-12 education in the United States. Its report, published two years later, was based on a review of the research literature and on briefings and written submissions from a wide range of researchers, educational practitioners, software developers, and representatives of governmental agencies, professional societies, and industries involved in various ways with technology in education. The report presents six high level strategic recommendations.

The first of these is "**Focus on learning *with* technology, not *about* technology**." They write that ". . . it is important to distinguish between technology as a subject area and the use of technology to facilitate learning about any subject area" (Panel on Educational Technology, 1997, p. 128). The Panel distinguishes between isolated computer education courses, which teach

students about computers and computer related basic skills, and the integration of meaningful and creative uses of computer technology throughout K-12 education. "The greatest promise of educational technology," they write, "lies in the possibility of utilizing computers and networks as an integral part of virtually all aspects of the curriculum" (p. 116).

The Panel's second recommendation is similar to the first: "**Emphasize content and pedagogy, and not just hardware**." They advocate using technology to help students develop "the ability to acquire new knowledge, to solve real-world problems, and to execute novel and complex tasks" (p. 115). The Panel writes, "Particular attention should be given to . . . new pedagogic methods based on a more active, student-centered approach to learning that emphasizes the development of higher-order reasoning and problem solving skills" (p. 128).

In short, the President's Panel on Educational Technology argues for addressing computer use as a kind of literacy. Indeed, changes in communications technologies over the past century have created a world culture that has extended and reshaped our symbolic environment. As early as 1964, Marshall McLuhan (1964) called it "the global village." Today, most Americans receive the majority of their news, information, and entertainment through electronic sources. It only makes sense that we should teach our children to use those sources well, and that we should make the use of nonprint electronic media an integral part of day-to-day activities in every classroom in this country.

STANDARDS FOR NONPRINT MEDIA AND TECHNOLOGY INTEGRATION

In *National Standards in American Education: A Citizen's Guide*, Diane Ravitch writes, "A standard is both a goal . . . and a measure of progress toward that goal" (1995, p. 7). She continues, "Standards tell everyone in the educational system what is expected of them; assessments [of standards] provide information about how well expectations have been met" (p. 27). Arguably, technology integration standards of this sort are needed for the use of electronic media to become an integral part of the daily activities undertaken in America's classrooms.

The Panel on Technology (1997), for example, notes that, for the most part, the use of computers in American schools involves either learning *about* technology or is focused on drill

and practice in basic skills. Most computers, they found, are located in isolated computer rooms rather than integrated into the environment of classrooms. Other national studies have reported similar findings (Becker, 1994; Educational Testing Services, 1998). Researchers agree that the biggest reason for such underutilization is lack of understanding. Our own research (Swan, et al., 1997) suggests that teachers just don't know how to make nonprint media an integral part of day-to-day learning in their classrooms. Electronic literacy standards would provide needed guidance.

It should be noted that in focusing on nonprint media and technology literacy we are not suggesting that print literacy is not important. We believe that reading and writing are, and will continue to be, at the heart of literacy. We simply believe that the tools we use to read and write are changing; that the symbol systems through which we communicate are expanding to assign a growing importance to images (Kress, 1998; Stephens, 1998); and that teaching and learning should likewise expand their range to incorporate these new tools and symbol systems. We don't herein address print literacy because we think it is being adequately addressed in schools. In our opinion, nonprint media and technology literacy is not.

It is our belief that nonprint literacy and technology integration standards should meet several criteria:

- Nonprint media and technology integration standards should be applicable across subject areas and grade levels. Electronic media have become an integral part of American life; nonprint literacy standards should emphasize the importance of their use as integral to teaching and learning across the curriculum. In addition, common standards allow for comparisons across subjects and grade levels.

- Nonprint media and technology integration standards should address critical and creative uses of electronic media, as well as basic technological skills. The Panel on Technology (1997) emphasizes the importance of the former, especially in the new information environments being created by such technologies. Renee Hobbs (1998, p. 5) writes, ". . . it is the sophisticated analysis, evaluation and the active creation of messages that are the most significant, complex and vital skills needed for survival in an information age."

- Nonprint media and technology integration standards should address issues of graphical and video literacy and the responsible use of information, as well as the literate use of computers and communication technologies. For the use of electronic media to be perceived as a central part of teaching and learning, standards for their incorporation should address issues central to schooling as we know it. Nonprint literacy and technology integration standards should also address real world use of communications media. They should include "the visual language of film and television, commercial and political advertising, and more" (National Council of Teachers of English/International Reading Association, 1996, p. 2).

- Nonprint literacy and technology integration standards should identify classes of observable performances. Ravitch (1995, p. 11) writes, ". . . a standard is not useful or meaningful unless there is some way to measure whether it is reached." This is especially true in the uncharted waters of technology integration. On the other hand, such standards should not be as specific as performance objectives if they are going to be adopted across districts and states. They should specify desired kinds of performances but leave specific objectives and measurements to local educators. The lists developed in the latter sections of this paper are intended to precipitate an ongoing conversation about technology integration and changing notions of literacy. They are not at all intended as the final word on the subject.

The next sections of this paper describe the development of a preliminary set of nonprint media and technology literacy standards.

DEVELOPMENT OF NONPRINT LITERACY STANDARDS

Diane Ravitch (1995, p. xxvi) writes, ". . . those who develop standards should recognize their role is to discover and explain the very best existing standards, not to invent new and untried ones." In the case of nonprint literacies, three sets of national standards collectively identify competencies in the use of nonprint media that experts and practitioners believe students should have by the completion of elementary, middle, and high school:

- *National Educational Technology Standards for Students*
- *Information Literacy Standards for Student Learning*
- *Standards for the English Language Arts*

We used these three sets of standards as the basis for our proposed nonprint media and technology literacy standards because the three are national in scope, constructivist in approach, and view media and technological competencies as part of a larger notion of literacy. The three sets taken together address technological literacy, information literacy, and literacy in general. All three sets of standards were developed by the leading professional organizations in their specific areas of interest and were revised through extended, open processes of review and revision that included parents, teachers, administrators, software developers, and media

specialists, as well as educational technology experts. The paragraphs that follow describe each set of standards, and tell how individual performance-based competencies were derived from them.

The *National Educational Technology Standards (NETS) for Students* were developed by the International Society for Technology in Education (ISTE, 1998), the leading professional organization for people specializing in technology and K-12 education, as part of the larger National Educational Technology Standards (NETS) Project. The NETS Project is co-sponsored by the US Department of Education, the National Aeronautics and Space Administration (NASA), the Milken Exchange on Educational Technology, and Apple Computer.

The *NETS for Students* are organized into six broad categories – basic operations and concepts; social, ethical, and human issues; technology productivity tools; technology communications tools; technology research tools; and technology problem-solving and decision-making tools. There are fifteen general standards altogether. These, in turn, are linked to performance indicators, called *Profiles for Technology Literate Students*, which describe the technology competencies students should exhibit by the completion of the second, fifth, eighth, and twelfth grades. Ten performance indicators are given for each level. These performance indicators formed the foundation for our nonprint media and technology literacy standards.

The *NETS for Students* performance indicators frequently address multiple standards categories and multiple media. In the lists we developed, we often extracted single profiles from these multiple competencies in order to focus on individually observable behaviors. Profiles of students completing the second and fifth grades were collapsed to form a single set of competencies for the elementary level. Performance indicators for students completing the eighth and twelfth grades were assigned to middle and high school levels respectively. *The NETS for Students* performance indicators are cumulative; that is, by the completion of high school, students should have acquired all of them. We maintained this cumulative approach for our nonprint media and technology literacy standards.

The *Information Literacy Standards for Student Learning* were developed by the American Association of School Librarians (AASL, 1998) and the Association for Educational Communication and Technology (AECT). Because they address certain information literacy competencies not addressed by the NETS, we included them in the development process of our

nonprint media and technology literacy standards. The *Information Literacy Standards for Student Learning* are broken into three general categories — information literacy, independent learning, and social responsibility — that consist of three standards each. Several performance indicators (29 in all) are given for each standard, and for each of these, three levels of proficiency are described. These performance descriptions are at a level of specificity suitable to direct observation and roughly identify what students should be able to do on completion of elementary, middle, and high school. Thus they were added almost exactly as they were to the lists of nonprint media and technology literacy standards we were developing.

The *Standards for the English Language Arts* were developed by the International Reading Association (IRA) and the National Council of Teachers of English (NCTE) (NCTE/IRA, 1996). They address literacy in general, but place nonprint competencies squarely within this category:

> Changes in technology and society have altered and will continue to alter the ways in which we use language to communicate and to think. Students must be prepared to meet these demands (p. 2).

We felt the *Standards for the English Language Arts* helped situate nonprint literacy within the broader category of literacy in general. For example, they focus on meaning making across media, a concept ignored in the other standards we used.

The *Standards for the English Language Arts* consist of 12 very broad standards, elaborations on these, and a series of classroom vignettes that illustrate how the standards might be manifest in classroom settings. Although the 12 standards are quite general in scope (in fact, they have been criticized for their lack of specificity), their elaborations provide specific examples of nonprint media competencies that, when broken out individually, can be directly observed. These elaborations, as previously indicated, address specific critical and creative abilities not elsewhere described. Thusly appropriated, such competencies were included in our nonprint media and technology literacy standards.

Once we identified all the nonprint media and technology competencies found in these three sets of standards, we reworked them into simple expressions of observable performances (open to local interpretation), and eliminated redundancies. The resulting performance standards were then sorted into three categories – basic skills, critical literacies, and construction skills – to

reflect the kinds of competencies many experts believe students should be developing around nonprint media and computing technologies (Panel on Educational Technology, 1997).

NONPRINT LITERACY PERFORMANCE STANDARDS

We use the term "nonprint media" rather than "electronic media" to be sure to include and focus on the wide range of graphical representations (e.g., photographs, drawings, diagrams, charts, graphs, maps) that are becoming an increasingly important part of communication. We use the term "technology literacy" instead of "electronic literacy" to be sure to include and to focus on the wide range of information technology competencies (e.g., searching, evaluating, analyzing, and synthesizing information from diverse sources) that are becoming an increasingly important part of knowledge building in all domains. But the term "nonprint media and technology" is, of course, intended to include the burgeoning variety of electronic media that forcing us to change our conceptions of literacy in the first place – video, computing, and communications technologies in particular.

The nonprint media and technology literacy competencies have been broken into three categories: basic skills, critical literacies, and construction skills.

According to Tyner (1996), two kinds of literacy are taught in schools. Tool literacies focus more on functional, simple meanings and basic use – what Hobbs (1998) calls *access*. Our basic skills category focuses on learning to use nonprint media and computing technologies as tools. Literacies of representation, on the other hand, stress the need to analyze information and understand how meaning is created. Traditional (print-based) literacy addresses both kinds of literacy. Too often nonprint media and technological competencies are only addressed at the tool level. We therefore have highlighted literacies of representation in the critical literacies and construction skills categories.

Basic skills, critical literacies, and construction skills are described in the sections that follow, and specific competencies for each category are given at the elementary, middle, and high school levels. The lists of standards should be understood as tentative. It should also be kept in mind that the standards lists were derived from existing national standards and were not

constructed by us. Thus, while we agree with most of the individual competencies, we do not necessarily agree with all of them. And, we think there may be important competencies missing that represent literate behaviors that are unique to emerging electronic media. We feel confident in arguing, however, that the lists we have assembled provide a good starting point for discussing nonprint literacy and for guiding and assessing technology integration in our schools. In particular, the sorting of the standards into basic skills, critical literacies, and construction skills suggests more sophisticated and literate ways of understanding nonprint media and technology literacy and provides a way of assessing not just the extent but the quality of technology integration efforts.

Basic skills are competencies involving the use and simple manipulation of nonprint media and the recognition of common conventions used by them. They include competencies related to accessing, decoding, encoding, and locating. In the list that follows, the basic skills students should have by completion of elementary, middle, and high school are given, in that order. These skills should be understood as cumulative; that is, by the completion of high school, students should have acquired all of them.

NONPRINT LITERACY STANDARDS

BASIC SKILLS

Elementary School

- Use a mouse to successfully operate a computer
- Use a keyboard to successfully operate a computer
- Keyboard
- Use a computer monitor
- Use a computer printer
- Use a scanner
- Use a digital camera
- Operate a VCR
- Operate an audio tape player
- Use interactive books
- Use developmentally appropriate multimedia encyclopedias
- Use content-specific educational software to support learning
- Use a variety of nonprint media resources for directed and independent learning activities

Elementary School (cont.)

- Use a word processor
- Use computers to compose texts
- Use computers to compose graphical representations
- Use multimedia authoring tools
- Use computers to search a variety of databases
- Use data collection probes
- Use calculators
- Use e-mail
- Participate in online discussions
- Use a browser to navigate the WWW
- Use search engines to locate and access remote information
- Use productivity tools and peripherals to support personal productivity
- Communicate about technology using accurate terminology
- Demonstrate knowledge of video conventions
- Demonstrate knowledge of computing conventions
- Give examples of situations where more information is needed to solve a problem
- List ideas for identifying and finding needed information
- Describe several ways to organize information
- Name a variety of formats for presenting different kinds of information
- Practice responsible use of technology systems and software
- Work cooperatively using technology

Middle School

- Use content-specific computer simulations to support learning
- Use exploratory environments to support learning
- Use graphing calculators
- Use computers to search the Internet
- Use communications and computing technologies to locate information efficiently
- Brainstorm a range of information sources to meet a specific information need
- Use productivity tools and peripherals to support group collaboration

High School

- Take notes and gather data from nonprint sources
- Use online information resources for research
- Use technology tools and resources for managing personal/professional information
- Use technology tools and resources for communicating personal/professional information

High School (cont.)

- Use online resources to enhance personal/professional productivity
- Discuss real world applications of expert systems
- Discuss real world applications of intelligent agents
- Discuss real world applications of simulations
- Explore a range of sources to find information of personal/professional interest
- Use and cite others' work appropriately and correctly

Critical literacies are competencies concerned with the ability to interpret, critique, and evaluate nonprint texts, to synthesize information found within them, and to apply them in solving problems and increasing personal understandings. They include such abilities as making sense, analyzing, evaluating, and applying. The cumulative critical literacies students should have by completion of elementary, middle, and high school are listed below.

NONPRINT LITERACY STANDARDS
CRITICAL LITERACIES

Elementary School

- Make sense of a variety of graphical representations
- Demonstrate listening skills
- Make sense of films and videos
- Make sense of simple computer programs
- Make sense of WWW pages
- Use computer-based puzzles and logical thinking software to support problem-solving activities
- Use a variety of graphical representations to acquire information
- Use audio presentations to acquire information
- Use films and videos to acquire information
- Use a variety of computer-based resources to acquire information
- Discuss and critique audio presentations
- Discuss and critique films and videos
- Discuss and critique computer programs
- Discuss and critique WWW sites
- Use a variety of nonprint media to build self-knowledge
- Use a variety of nonprint media to understand cultures
- Distinguish between accurate and inaccurate, complete and incomplete information

Elementary School (cont.)

- Define and/or give examples of accuracy, relevance, comprehensiveness, appropriateness, and bias in nonprint media and/or electronic resources
- Distinguish between fact, opinion, and point of view in a variety of nonprint media and/or electronic resources
- Evaluate the accuracy, relevance, appropriateness, and bias of a variety of nonprint resources
- Recognize and make sense of new information in nonprint sources
- Define and/or give examples of equity in access to information resources and technologies
- Define and/or give examples of intellectual freedom
- Define and/or give examples of respecting intellectual property rights
- State the main points of school policy concerning computing and communications technologies
- Discuss basic issues related to the responsible use of technologies
- Demonstrate positive social and ethical behaviors when using technology
- Discuss the advantages and disadvantages of common uses of technologies
- Select and use appropriate technology tools to complete a variety of tasks

Middle School

- Analyze and explain graphical representations
- Analyze and explain audio presentations
- Analyze and explain films and videos
- Distinguish the uses of graphical representations
- Distinguish the uses of audio presentations
- Distinguish the uses of films and videos
- Distinguish the uses of WWW sites
- Evaluate nonprint media
- Synthesize information from nonprint media
- Select and use appropriate technology tools and resources to complete a variety of tasks
- Explain how inaccurate or incomplete information can lead to faulty conclusions
- Compare and contrast nonprint information sources for accuracy, relevancy, comprehensiveness, and bias
- Create a plan to access information that meets a particular need
- Analyze information from a variety of sources to determine its applicability to a specific problem
- Assess both the process and the product of a specific information search
- Use multiple and diverse information sources to answer questions or resolve problems
- Demonstrate positive ethical and legal behaviors when using information and technology resources
- Demonstrate knowledge of current information technologies
- Demonstrate an understanding of the effects technological changes have on society and the workplace

Middle School (cont.)

- Discuss the consequences of the misuse of information and/or technologies
- Demonstrate an understanding of the concepts underlying hardware, software, and connectivity tools
- Apply strategies for identifying and solving routine hardware and software problems

High School

- Choose the most appropriate formats for presenting a range of information
- Critique and evaluate advertising campaigns for a variety of products
- Recognize and compare different media genres
- Evaluate the strengths and weaknesses of various creative presentations
- Judge the quality of one's own information products and solutions
- Judge the accuracy and completeness of information and support those conclusions
- Appropriately distinguish between fact, opinion, and point of view in one's own nonprint work
- Evaluate the electronic information seeking process as it evolves and make appropriate adjustments
- Discuss and evaluate technology-based options for lifelong learning
- Identify capabilities and limitations of current and emerging technologies
- Assess the potential of current and emerging technologies to address personal and workplace needs
- Make informed choices among technology systems, resources, and services
- Analyze the advantages and disadvantages of the widespread use of technology in society
- Advocate for ethical and legal behaviors when using information technology

Construction skills are competencies involving the creation and use of nonprint texts for developing ideas and opinions, for communicating and collaborating with others, and for enhancing problem solving and personal fulfillment. Construction skills focus on capabilities for composing, developing, integrating, and presenting. The construction skills students should have by completion of elementary, middle, and high school are presented in the list which follows. The skills should be understood as cumulative.

NONPRINT LITERACY STANDARDS
CONSTRUCTION SKILLS

Elementary School

- Use computer-based writing tools to communicate thoughts, ideas, and stories
- Use computer-based drawing tools to illustrate thoughts, ideas, and stories
- Use digital cameras to illustrate thoughts, ideas, and stories
- Use multimedia authoring tools in the creation of knowledge products
- Use presentation software in the creation of knowledge products
- Use WWW authoring tools in the creation of knowledge products
- Use audio tapes for self-directed and/or extended learning
- Use videos for self-directed and/or extended learning
- Use technology resources for self-directed and/or extended learning
- Use technology resources for problem solving
- Create nonprint media for personal fulfillment
- Explain basic strategies for revising, improving, and updating nonprint media
- Use telecommunications technologies to participate in collaborative projects
- Work collaboratively to seek and/or communicate information in nonprint formats
- Work collaboratively to create simple nonprint information products

Middle School

- Use nonprint media to create knowledge
- Use nonprint media to communicate
- Differentially organize information according to differing problems
- Choose appropriate media formats for presenting a variety of information
- Use nonprint media to create information products related to topics of personal interest
- Express information and ideas creatively in nonprint formats
- Design, develop, and present videotapes that communicate curriculum concepts
- Use telecommunications and collaborative tools to collaborate with peers, experts, and others on curriculum related problems
- Work collaboratively over distance to create and evaluate complex information
- Select and apply appropriate strategies for revising, improving, and updating work

High School

- Use technology to collaborate with others to contribute to a content-related database
- Select and apply technology tools to support research in content learning
- Select and apply technology tools for decision making in content learning
- Select and apply technology tools for problem solving
- Select and apply technology tools for information analysis
- Differentially organize information so that it is effectively presented in a single nonprint product
- Express ideas creatively and/or uniquely in integrative nonprint formats
- Collaboratively create complex information over distance
- Collaboratively evaluate complex information over distance
- Devise creative ways to use information to resolve problems and/or answer questions

To reiterate, the above lists of nonprint media and technology literacy competencies are offered as a starting point. We hope they will begin a discussion of what one should know and what one should be able to do to be considered literate in the 21st century. Thus, they are also intended to precipitate discussions of how we should be teaching and learning about literacy in our schools today.

Most importantly, we hope the lists will encourage educators to extend traditional notions of literacy to include critical and creative uses of images, video, and electronic texts of all sorts. We hope they will encourage educators to stop treating technology as a separate subject to be taught, often as a "pull-out," and to start treating the use of electronic media as a form of literacy to be integrated across the curriculum. In particular, we hope that educators will take special note of the critical literacies and construction skills categories and make mindful efforts to include these whenever they incorporate technology usage in teaching and learning.

Secondly, it should be remembered that the lists of nonprint media and technology literacy competencies are derivative. They have been culled from standards generated by the premier professional organizations concerned with technology, information literacy, and the English language arts. On the one hand, this situates them in public practice. Indeed, we believe much of their strength comes from the fact that they have been painstakingly socially constructed. On the other hand, the lists may contain some dubious concepts and/or be missing others. In particular, certain critical literacies and construction skills that may be unique to visual and electronic media

– for example, bricolage and juxtaposition (Burbules, 1998) and display and arrangement (Kress, 1998) – perhaps should be included.

Guiding and Assessing Nonprint Literacy and Technology Integration

Beyond initiating long overdue discussions concerning the nature of literacy in an electronic age, the nonprint media and technology literacy standards can be used in several differing ways to guide and assess nonprint literacy and technology integration. Most importantly, they provide lists of authentic and observable performances that focus on basic, critical, and construction skills. They can thus be used to guide and assess not only the extent but the quality of nonprint literacy and technology integration. In particular, the lists provide a means for determining the extent to which critical and constructive competencies are supported in technology-based teaching and learning. We think this is particularly important when experts suggest that critical and constructive uses of technology are more likely to foster learning than basic uses (Panel on Educational Technology, 1997, p. 8).

We imagine the standards being used in a variety of different ways. Because assessment clearly guides implementation, only the assessment of technology integration is discussed in the paragraphs that follow. Guidance, however, should be understood as entailed therein.

To begin with, the nonprint media and technology literacy standards detailed above could be used to document and qualify technology integration in classrooms. Such documentation would be a necessary first step in any study of the effects of technology integration on learning, such as those called for by the Panel on Educational Technology (1997). It might be an end in itself, as in, for example, documenting the use of technology for reporting on grants aimed at technology integration. In both cases, the nonprint media and technology integration standards can be applied to a lesson or a curriculum, a classroom, school, or school district. Because the standards can be applied across subject areas and grade levels, they can be applied across the curriculum and/or used to compare technology integration using a variety of variables.

On another level, the nonprint media and technology literacy standards could be used to assess professional development activities, such as those mandated by the President's

Technology Literacy Challenge (Executive Office of the President, 1996). It stands to reason that the ways in which teachers are trained to use electronic media will be reflected in the ways they use such media in their own classrooms. We have seen too many professional development programs that focus on basic skills, and too few that even address critical and creative uses of nonprint media. The standards might simply be used to document professional development activities or used to correlate professional development with classroom uses of nonprint media on a qualitative basis. In either case, nonprint media and technology literacy standards facilitate the comparison of differing programs and/or models of professional development.

Finally, the nonprint media and technology literacy standards could be used to assess student learning. After all, the ultimate aim of any technology integration or professional development program is that students will develop competencies in the use of electronic media. We believe that for students to grow into productive workers and responsible citizens of the 21st century, they will need to be able to do more than just use nonprint media and/or computing technologies. We believe ". . . it is the sophisticated analysis, evaluation and the active creation of messages that are the most significant, complex and vital skills needed for survival in an information age" (Hobbs, 1998, p. 5). The nonprint media and technology literacy standards proposed here assess student learning of such skills and distinguish between them and more basic competencies. They are at least a step in the right direction.

There is a good deal of evidence that shows that concepts of literacy are not just socially and politically constructed, but that they are also materially determined. That is, technologies of reading and writing evolve and change over time and those changes are reflected in changes in what it means to be literate within a society (Bolter, 1991; Haas, 1998). The dominant technologies of reading and writing have evolved and changed dramatically in our society over the past half century, but those changes are not reflected in the literacy curricula of our schools. It is past time we revised school-based conceptions of literacy. If we do not, schools will simply cease to be relevant. The nonprint media and technology standards presented in this paper are offered as a starting point for thinking and talking about the ways we need to change schools and schooling to embrace electronic forms of communication as we enter the 21st century.

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